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INNOVATIVE EDUCATION AND SCIENCE IN INFORMATION TECHNOLOGIES: EXPERIENCE OF N.Ye. ZHUKOVSKY NATIONAL AEROSPACE UNIVERSITY (KhAI)

Information technologies are among the most promising and fastest growing sectors in the world and in the Ukrainian industry. Herein, the authors share the experience of National Aerospace University (KhAI) in the personnel education and training for the IT industry and the results of successful cooperation with IT companies. Innovative education programs, as well as scientific and practical researches in the field of information technologies, which are implementing in KhAI have been discussed.

K e y w o r d s : software, information and computer technologies, academic and industrial consortium, and training of specialists.

STATUS AND PROSPECTS OF INFORMATION TECHNOLOGY IN THE WORLD AND IN UKRAINE

Several years ago, the global IT industry revenue was estimated at USD 3 trillion that accounted for 6% of the total value of all globally produced goods and services. According to MsKinsey, it will reach 9%, till 2020.

According to the National Commission for regulation of communications and IT development in Ukraine, in 2013, the share of information technology in gross domestic product (GDP) made up 1.24%. This value is planned to increase to 5–8% of GDP in the next three years. For comparison, in South Korea, the share of ICT in GDP exceeds 10%; in India, it is more than 8%; in China, it accounts for 6%; in the UK, it makes up about 5%; in the USA, it is over 4%; and in Russia, it comes to 2.4%.

Ukraine is among the five world leaders in the export of software falling behind India, China, Russia, and Brazil. Against the background of falling industrial production, the exports of goods and services in information technology can become an important source of revenues for Ukraine in the next few years.

At the same time, it is necessary to recognize that the technological export of Ukraine is based on the software rather than on the innovative technology or the intellectual property rights. For example, in South Korea, the share of software outsourcing accounts for only 8% of exports, while that of information and communication services makes up 19%, with high-tech hardware and software constituting 73% of exports. Therefore, in parallel with the further development of the IT industry, Ukraine needs to change the market structure as well through shifting the focus from outsourcing to creating and exporting innovative technologies and holding intellectual

property rights (IP and IT-rights). Addressing this problem requires awareness of its importance and concerted efforts of both IT companies and the state in the legislative, regulatory, and higher education field to improve the quality of training in rapidly developing information and communication technologies.

EXPERIENCE OF THE NATIONAL AEROSPACE UNIVERSITY (KHAI) IN TRAINING PERSONNEL FOR IT INDUSTRY

Information and computer technology is an important component of the educational process at the National Aerospace University for any and all areas of training. Almost every department of the University has several computer classes; all the faculties have operating data centers.

At the annual conference of labor collective, in January 2015, V. Krivtsov, the Principal of the University, identified three basic principles of the development of training activities at the University:

• *First*, the students should get in-depth knowledge of the chosen field, which is a traditional feature of education in KhAI;

✦ *Second*, all graduates and teachers of KhAI must be fluent in English that is a necessary tool for international communication among the professionals;

✦ *Third*, the students should possess professional skills in computer and information technology (including computer-aided design packages, mathematical modeling tools) to be able to develop applications and to perform computer-aided calculations.

These three key requirements apply to any direction of engineering education, including aircraft and spacecraft building, engine design, radio-electronics, telecommunications, and economic engineering.

Keeping abreast with rapid development of information and communication technologies, the National Aerospace University has been established departments specializing in training specialists in computer engineering, software en-

gineering, computer science, information science, telecommunications, and safety of information and communication systems.

The importance and success of this approach can be testified by both high popularity of these areas among the students and by high employment rate of the graduates. For example, in 2014, the highest admission score among all higher educational institutions of Ukraine was reported for the budget funded education in computer engineering at KhAI (569.5) as compared with *Lvivska Politeknika* (566.5); *NTU KPI* (565); *KhNURE* (555). In addition, according to a poll on Web-portal DOU.UA (http://dou.ua/lenta/articles/ukrainian-universities-2014/), KhAI is top ranked in terms of completeness of knowledge, as well as quality and usefulness of IT education among the Ukrainian universities.

EXPERIENCE OF COOPERATION WITH IT COMPANIES

It should be noted that today, in Ukraine, there is a significant shortage of IT professionals. Annually, around 15,500 IT professionals graduate from universities, which does not meet the needs of the industry estimated at 150–170 thousand, in 2015. This problem is of global nature. According to the European Commission, in 2015, a projected shortage of IT staff in the EU is estimated at 900,000 employees, given the fact that the annual number of graduates in this field is about 100 thousand.

The solution to this problem is impossible without close cooperation between the Ministry of Education, universities, and IT companies. The association of universities and IT companies in academic and industrial consortiums offers great opportunities for mutually beneficial cooperation, including:

✦ Joint innovative research projects resulting in the establishment of startups and spin-offs and the commercialization of university research;

✦ The improvement of the quality of higher education in the IT industry and training of future employees of IT companies on the advanced information technologies by experts of these companies at specialized courses; the involve-

ment of students in apprenticeship at IT companies, and the update of topics for the course papers and degree projects of students.

The National Aerospace University has experience of such cooperation with *Microsoft*, *Samsung R&D*, *Mirantis Ins.*, *Eras Systems*, *DataArt*, *Sigma*, etc. Together with the Odessa National Polytechnic University, the National University of Chernivtsi, the Chernihiv State University, and the Black Sea State University KhAI is a member of academic and industrial consortium comprising universities and IT companies from the UK, Spain, Portugal, Ukraine, and Sweden. This consortium was created upon an initiative of researchers and teachers of the KhAI Department for Computer Systems and Networks to develop and implement models of cooperation between the universities and the IT industry as part of the *TEMPUS-SAVRIOLET Model-Oriented Approach and Intelligent Knowledge-Based System for Evolvable Academia-Industry Cooperation in Electronics and Computer Engineering* (2013–2016).

Thus, the creation of various "*university – IT company*" consortia, alliances, and associations to address current and future challenges based on the experience and mutual cooperation is a promising way of raising efficiency of IT education and enhancing the innovation component of domestic companies in order to create state-of-the-art scientifically based computer technologies.

PROMISING EDUCATIONAL PROGRAMS AND RESEARCH IN THE FIELD OF INFORMATION TECHNOLOGY, WHICH ARE IMPLEMENTED IN THE UNIVERSITY

The priority task of the university is to ensure a quality training of specialists for high-tech industries of Ukraine's economy that has be at the forefront of the national and the world science. The global experience shows that this is just advanced R&D activities that contribute to revolutionary changes in the computer and communication technologies and to raising efficiency of evolutionary processes in the higher education.

To generate a competitive education and research in computer engineering and in safety of informa-

tion and communication systems, the Department of Computer Systems and Networks of the National Aerospace University (KhAI) has been conducting R&D works and implementing academic courses for the Masters and PhD students on the cutting-edge Cloud Computing and energy efficiency (Green Computing) technologies developed within the framework of international TEMPUS projects. The postgraduate students and teachers are involved in the research related to designing the architecture, evaluating the performance and ensuring the security and reliability of cloud-based service-oriented systems, as well as in the development of energy-efficient hardware and software, the creation of environmental wireless networks and building of "green" data centers.

Among the practical results of this research, there is an innovative concept of "green" university in Ukraine, which enables implementing the principle of energy saving without a costly replacement of major systems and communications. This concept is combined with the use of cloud technologies. The essence of innovative project that is being implemented is to bring together all the energy systems of the university (including hot water supply system, heating system, lighting control system, etc.) in a single network managed from a cloud server. This makes it possible to access information about the current status of each valve in the system, energy loss in certain areas or heating mains, inefficient use of lighting and other nuances, which help to optimize energy consumption at minimum cost. The main advantage of is system is completely automated processes excluding the human factor as weak link of any system.

Creating such a system is a priority for the university not only because it enables saving extra money, but also because it is an opportunity for engaging the students in the design and implementation of this system. In addition, this approach encourages the students to work independently in large projects that go beyond the scope of university curriculum. A lion's share of the work is planned to be done by the Student Lab for Mobile and Wireless Technologies at the Department of Computer

Systems and Networks. The laboratory team consists of 3- and 4-year students and graduates of KhAI and is coordinated by the teaching staff.

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ІННОВАЦІЙНА ОСВІТА ТА НАУКА В ГАЛУЗІ ІНФОРМАЦІЙНИХ ТЕХНОЛОГІЙ: ДОСВІД НАЦІОНАЛЬНОГО АЕРОКОСМІЧНОГО УНІВЕРСИТЕТУ ім. М.Є. ЖУКОВСЬКОГО «ХАІ»

Інформаційні технології є однією з перспективних галузей світової та вітчизняної індустрії, яка розвивається стрімкими темпами. В статті автори діляться досвідом Національного аерокосмічного університету «ХАІ» з підготовки фахівців для ІТ-галузі **та** результатами успішної кооперації університету з ІТ-компаніями. Також розглянуто перспективні освітні програми та науково-практичні дослідження в галузі інформаційних технологій, що впроваджуються в ХАІ.

Ключові слова: програмне забезпечення, інформаційні та комп'ютерні технології, академічно-промисловий консорціум, підготовка фахівців.

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ИННОВАЦИОННОЕ ОБРА ЗОВАНИЕ И НАУКА В ОБЛАСТИ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ: ОПЫТ НАЦИОНАЛЬНОГО АЭРОКОСМИЧЕСКОГО УНИВЕРСИТЕТА им. Н.Е. ЖУКОВСКОГО «ХАИ»

Информационные технологии являются одной из перспективных и быстроразвивающихся отраслей мировой и отечественной индустрии. В статье авторы делятся опытом Национального аэрокосмического университета «ХАИ» по подготовке специалистов для ИТ-отрасли и результатами успешной кооперации университета с ИТ-компаниями. Также рассмотрены перспективные образовательные программы и научно-практические исследования в области информационных технологий, которые реализуются в ХАИ.

Ключевые слова: программное обеспечение, информационные и компьютерные технологии, академически-промышленный консорциум, подготовка специалистов.