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CURRENT STATE OF THE HIGHER TECHNICAL EDUCATION AND TRENDS OF ITS DEVELOPMENT IN UKRAINE IN THE CONTEXT OF EUROPEAN EDUCATIONAL PROCESSES

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Ukraine is a part of the European educational environment and obligatorily reacts to global changes, thus Ukraine strives to improve modern higher education and, in particular, technical education. Higher education is an integral part of the harmonious life of a modern, developed citizen, and obtaining it is a key to success in the modern world. Every year certain changes occur in the system of higher education at the global level, and Ukraine doesn't stay aside. With the challenge of today's requirements, the introduction of the latest methods and learning technologies is an important component of further success and the highly qualified employees' training. The main problem that leading experts in the field of education care about and try to eliminate, is to overcome difficulties and obstacles that arise.

Higher technical education has been attracting applicants from different parts of Ukraine for many years, as specialists in various technical specialties are in high demand on the labor market. The system of higher technical education in Ukraine is constantly developing and, as a result, the personnel potential, that is responsible for the specialist's training in various fields, is increasing. The article examines the system of higher technical education on the example of three technical universities of Ukraine: National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Zhytomyr Polytechnic State University and Lviv Polytechnic National University.

The article analyzes institutes, faculties and specialties that provide technical training. The number of educational programs at each educational degree is shown and the possibilities of obtaining the corresponding degree are investigated. Development and improvement prospects in various higher technical institutions of Ukraine are outlined.

Keywords: *higher education, higher technical education, higher technical educational institution, educational programs, educational degrees, technical faculties, technical specialties.*

СУЧАСНИЙ СТАН ТА ТЕНДЕНЦІЇ РОЗВИТКУ ВИЩОЇ ТЕХНІЧНОЇ ОСВІТИ УКРАЇНИ В КОНТЕКСТІ ЄВРОПЕЙСЬКИХ ОСВІТНІХ ПРОЦЕСІВ

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Україна є частиною європейського освітнього середовища й неодмінно слідкує за світовими змінами, саме тому прагне вдосконалення сучасної вищої освіти, а зокрема, технічної

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освіти. Вища освіта є невід'ємною складовою гармонійного життя сучасного розвиненого громадянина, її отримання стає запорукою успіху в сучасному світі. Кожного року відбуваються певні зміни у системі вищої освіти на загальносвітовому рівні й Україна не є винятком. З викликом вимог сьогодення, впровадження новітніх методів та технологій навчання є важливим складником подальшого успіху та підготовки висококваліфікованих кадрів. Подолання труднощів та перешкод, що виникають, є головною проблемою, якою опікуються та намагаються усунути провідні фахівці галузі освіти.

Вища технічна освіта вже не один рік приваблює абітурієнтів з різних куточків України, оскільки фахівці з різних технічних спеціальностей є досить затребуваними на ринку праці. Система вищої технічної освіти в Україні невпинно розвивається та, відповідно, збільшується кадровий потенціал, який відповідає за підготовку спеціалістів у різних галузях. У статті розглядається система вищої технічної освіти на прикладі трьох технічних університетів України: Національного технічного університету України "Київського політехнічного інституту імені Ігоря Сікорського", Державного університету "Житомирська політехніка" та Національного університету "Львівська політехніка".

У статті проаналізовано інститути, факультети й спеціальності, за якими здійснюється технічна підготовка. Показано кількість освітніх програм на кожному освітньому ступені й досліджено можливості отримання відповідного ступеню. Окреслено перспективи розвитку та вдосконалення в різних вищих технічних закладах України.

Ключові слова: вища освіта, вища технічна освіта, вищий технічний навчальний заклад, освітні програми, освітні ступені, технічні факультети, технічні спеціальності.

Introduction of the issue. Technical education is quite popular among education seekers of Ukrainian higher educational institutions, as it offers a number of promising specialties that are necessary in today's conditions. Higher technical educational institutions train specialists in various fields and at various degrees, thus forming the system of higher technical education of Ukraine. Each university sees its goal in creating such a training program that would include a sufficient amount of theoretical material, the study of which could be tested practically. The vast majority of higher technical educational institutions are like that, as they cooperate with various companies, brands, factories, and international organizations that provide an opportunity to try one or another profession even at the stage of the necessary qualifications obtained.

Current state of the issue. The problem of higher technical education is quite relevant with the new computer technologies development and introduction, modern material and technical base of most enterprises provision and, in general, various technical specialties specialists demand. Problems and prospects of the modern technical education development in

Ukraine are highlighted by Doctor of Technical Sciences Volodymyr Vanin, Doctor of Technical Sciences Hennadiy Virchenko, Candidate of Pedagogical Sciences Svitlana Kravets, Candidate of Pedagogical Sciences Svitlana Greben, Doctor of Pedagogical Sciences Halyna Kozlakova [2], Doctor of Pedagogical Sciences Bohdan Sus [2], Candidate of Physical and Mathematical Sciences Yulia Ivanova [2], Candidate of Historical Sciences Oksana Kovalenko [2], Candidate of Pedagogical Sciences Iryna Stavitska [2] and others. They and many other Ukrainian researchers consider the development of technical education in today's conditions, show the strengths and weaknesses of its obtaining, develop methods and implement modern learning technologies to increase the technical education level and the relevance of its acquisition.

Aim of the research is to analyze the current state of higher technical education and trends of its development in Ukraine in the context of European educational processes.

Results and discussion. In today's conditions, Ukraine is on the way to change and improve the system of higher technical education. The Cabinet of Ministers of Ukraine approved the draft

law, according to which learning should become more effective and introduce positive changes in the specialized personnel formation. This draft law "The Amendments to Certain Laws of Ukraine Regarding the Individual Educational Trajectories Development and the Educational Process Improvement in Higher Education" has not yet received the approval of the Verkhovna Rada of Ukraine, but it is important to note the changes it provides [5].

First of all, students of the contract form will be able to independently regulate the terms of their study. Studies can last from 3 to 6 years for bachelors, a student can have a workload of 30 to 80 ECTS credits per year, and therefore, get a bachelor's degree sooner or, on the contrary, in a longer period of time. Thus, the citizens' financial ability to pay for education is considered. Accordingly, some will have the opportunity to combine study with work and gain professional knowledge in a better way.

Secondly, it is planned to introduce interdisciplinary educational programs for bachelors. Several specialties will be combined into one broad field and after passing 60-120 ECTS credits, the student will be able to choose a specialty that is closer to him, in which he would like to realize himself. During this time, there is an opportunity to determine the profitability, financial advantage of the chosen profession, and then delve deeper into its study.

Thirdly, there will be a change of external and evening education forms to distance education. Students will have

the opportunity to independently choose the time and place of classes within the study schedule. This form is more common in European Union countries and is more effective, as a student can join classes from almost any location.

Of course, all innovations will not apply to students who have already entered and are studying on a contract or budget basis. So far, the above changes are submitted for consideration, but have already received the approval of many experts in the education and science field. Such modern solutions will bring Ukraine closer to even greater European integration.

The system of higher technical education in Ukraine is constantly developing and, accordingly, the personnel potential is increasing, as they are responsible for the specialists training in various fields. Let's consider the system of higher technical education on the example of several universities of Ukraine.

The most famous university of higher technical education in Ukraine is the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", which trains bachelors, masters, Doctor of Philosophy, and has its own publishing house "Polytechnic". The university is known for its honorable history and has 14 faculties, 10 educational and scientific institutes, several scientific research institutes and scientific centers.

Let's consider institutes, faculties and specialties that are affordable in the National Technical University of Ukraine.

Table 1

Institutes and specialties that are presented at the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"

[compiled by the author]

Institute of Special Communications and Information Protection	122 Computer science
	125 Cyber security and information protection
	172 Electronic communications and radio engineering
Institute of Publishing and Printing	023 Fine art, decorative art, restoration
	061 Journalism
	133 Industrial engineering
Institute of Aerospace Technologies	186 Publishing and printing
	134 Aviation and rocket and space technology
	173 Avionics

Institute of Nuclear and Thermal Energy	143 Nuclear power
	142 Energy engineering
	121 Software engineering
	122 Computer Science
	151 Automation and computer-integrated technologies
	144 Thermal power engineering
Institute of Energy Saving and Energy Management	141 Power engineering, electrical engineering and electromechanics
	184 Mining
Y.O. Paton Institute of Materials Science and Welding	131 Applied mechanics
	132 Materials science
	136 Metallurgy
Institute for Applied System Analysis	124 System analysis
	122 Computer science
Institute of Telecommunication Systems	172 Telecommunications and radio engineering
Institute of Mechanical Engineering	131 Applied mechanics
Institute of Physics and Technology	105 Applied physics and nanomaterials
	113 Applied mathematics
	125 Cyber security

We see that the university offers a wide range of educational services, some institutes even offer a form of dual education, such as the Institute of Aerospace Technologies. Moreover, the main partner in the specialists training is the American company "Firefly" that aims to realize the goal of "Accessible space", namely the exploration of space at the technical innovations expense. The dual form of education provides an opportunity to gain knowledge in two cities of Ukraine: Kyiv and Dnipro, where students study topics and try themselves in the real objects production and development.

The Institute of Telecommunication Systems actively cooperates with other countries: Germany, China, USA, France, Great Britain and Poland. The best students even have the opportunity to participate in scholarship programs and receive financial aid. Graduates of this institute have the opportunity to work in well-known companies: Lifecell, ALCATEL-LUCENT, "Ukrtelecom", "Ukrkosmos", Kyivstar, HUAWEI TECHNOLOGIES, Vodafone, NOKIA and many others [1].

The Mechanical Engineering Institute also works on the modern information and computer technologies basis, practices production complexes and capacities of well-known companies, and designs robotic systems. Graduates have the opportunity to earn high salaries in various Ukrainian and international companies: PROGRESTECH-Ukraine, BOEING, Antonov, Festo, Bosch-Rexroth, Camozzi, Kärcher, Hansa Flex, Siemens, Sigma Engineering, Kostal, Hidrosyla, Arsenal, Motor Sich, Progres and many others [4].

The Institute for Applied System Analysis works with advanced artificial intelligence technologies, develops models aimed at comprehensive analysis and state problems forecasting. Graduates are offered work as system analysts, heads of information systems development, project managers, computer systems engineers of national and international banks.

It is obvious that institutes partner with leading companies to facilitate and improve graduate employability. An absolute advantage is the presence of modern laboratories and appropriate equipment for better visual material

perception and the practical work possibility.

Then we will consider the Zhytomyr Polytechnic State University that is one of the most attractive higher education institutions for students throughout Ukraine, as it ranks 39th in the consolidated rating of Ukrainian higher

education institutions. The university is a guardian of modern learning methods, open to changes and daily improvement of the knowledge level and skills of students.

Zhytomyr Polytechnic State University offers a different number of educational programs by educational degrees [7]:

Table 2

Number of Educational Programs by Educational Degrees in Zhytomyr Polytechnic State University

Educational Degree	Number of Educational Programs
Junior Bachelor	3
Bachelor	38
Master's degree	27
Doctor of Philosophy	11

Zhytomyr Polytechnic State University offers a range of different specialties:

Table 3

Specialties offered to students at Zhytomyr Polytechnic State University

[compiled by the author]

Educational Degree	Specialties
Junior Bachelor	071 Accounting and taxation
	101 Ecology
	184 Mining
Bachelor	014 Secondary education
	033 Philosophy
	035 Philology
	051 Economy
	052 Political science
	053 Psychology
	071 Accounting and taxation
	072 Finance, banking, insurance and stock market
	073 Management
	075 Marketing
	076 Entrepreneurship, trade and exchange activity
	081 Law
	101 Ecology
	103 Earth Sciences
	121 Software engineering
	122 Computer science
	123 Computer engineering
	125 Cyber security
	126 Information systems and technologies
	131 Applied mechanics
133 Industrial engineering	
141 Power engineering, electrical engineering and electromechanics	
152 Metrology and information and measurement technology	
163 Biomedical engineering	
172 Telecommunications and radio engineering	
174 Automation, computer-integrated technologies and robotics	

	183 Environmental protection technologies
	184 Mining
	192 Construction and civil engineering
	208 Agricultural engineering
	232 Social security
	241 Hotel and restaurant business
	242 Tourism
	256 National security
	262 Law enforcement activity
	274 Road transport
	281 Public management and administration
	291 International relations, public communications and regional studies
	292 International economic relations
Master's degree	014 Secondary education
	051 Economy
	052 Political science
	053 Psychology
	071 Accounting and taxation
	072 Finance, banking, insurance and stock market
	073 Management
	076 Entrepreneurship, trade and exchange activity
	081 Law
	101 Ecology
	121 Software engineering
	122 Computer science
	123 Computer engineering
	125 Cyber security
	131 Applied mechanics
	133 Industrial engineering
	152 Metrology and information and measurement technology
	163 Biomedical engineering
	172 Telecommunications and radio engineering
	174 Automation, computer-integrated technologies and robotics
	183 Environmental protection technologies
	184 Mining
	241 Hotel and restaurant business
	242 Tourism
	256 National security
	262 Law enforcement activity
274 Road transport	
275 Transport technologies	
281 Public management and administration	
292 International economic relations	
Doctor of Philosophy	051 Economy
	071 Accounting and taxation
	072 Finance, banking, insurance and stock market
	073 Management
	101 Ecology
121 Software engineering	

	131 Applied mechanics
	184 Mining
	256 National security
	274 Road transport
	281 Public management and administration

Table 3 illustrates the various specialties at different faculties that are offered at Zhytomyr Polytechnic State University. It is important to note that the scientific and pedagogical staff regularly participates in both Ukrainian and international conferences and is actively involved in internships abroad. Moreover, the staff undergoes various training and improves knowledge in order to improve the quality of services provided.

Zhytomyr Polytechnic State University provides an opportunity for foreign citizens to obtain higher education. Ukrainian language courses and a number of other preparatory disciplines are held on the basis of the university. Students can study academic subjects in Ukrainian or English.

There is a regular assessment of the quality of the knowledge provided in this higher educational institution [7].

Table 4

Training licensed volume of higher education seekers at certain levels

Higher Education Level	Licensed volume (per year)
Initial level (short cycle)	90
First (Bachelor) level	3000
Second (Master's) level	1720
The third (educational-scientific/ educational-creative) level	130

As we see, the largest orders volume falls on the first (Bachelor's) level of higher education. There is the biggest number of applicants and a greater variety of specialties. At the initial level, there are the least number of places, and the fewest specialties offered, since there are constant discussions about this higher education degree. There is a possibility that in 2025 this level will cease to exist and the license to implement such educational activities will be revoked. In general, the university can accept a fairly large number of students and provide them with appropriate conditions for successful educational activities.

Zhytomyr Polytechnic State University cooperates with international organizations and is a member of: European University Association (EUA), European Business & Innovation Center Network (EBN), European Association for International Education International Education (EAIE), European Society for Engineering Education (SEFI), European Distance and E-Learning Network (EDEN), International Environmental

Organization "Global Nest" / Global Network on Environmental Science and Technology, Black Sea Universities Network (BSUN), Alliance of Ukrainian and Chinese Universities [6].

Various scientific circles operate on the basis of the university: "Web Application Development Technologies", "Computer Modeling in Technical Systems", "English TED-lab", "Young Philologist Laboratory", "International Relation and Diplomatic Lab" and many others. There are also various scientific and educational laboratories: "Biology and Hydrobiology", "Chemistry and Biogeochemistry", "Radioecology and Radiobiology", "Computer Networks and Cyber Security", "Cloud Technologies and Virtual Reality", "Problem of Higher Education Digital Transformation", "Electronics LAB" and many others [9].

The third largest higher technical educational institution is Lviv Polytechnic National University. In the annual ranking of the best universities in the world, World University Rankings 2023, by the British publication Times Higher Education, which includes 1,799

universities from 104 countries, Lviv Polytechnic National University has received high marks according to the results of the ranking. Lviv Polytechnic National University has been included to the group of 601-800 best universities in the world and is one of only two Ukrainian universities that are in the top 1000 world higher educational institutions [3].

The university has 22 modern educational and scientific centers and

laboratories, 39 educational and scientific buildings, 17 dormitories, 2 libraries, 1 innovation center Tech StartUp School, 1 business school Tech Business School, 1 astronomical observatory, 1 geodetic training ground, 1 publishing house, 4 educational health camps.

Lviv Polytechnic National University offers a large number of educational programs by degrees:

Table 5

The number of educational programs by educational degrees at Lviv Polytechnic National University

[compiled by the author]

Educational Degree	Educational-Professional and Educational-Scientific Programs
Bachelor	67
Master's	58
Doctor of philosophy	54
PHD	38

The university aims to educate and develop true citizens of their country, strong, free minded and spirited students who are able to think critically and find creative solutions in modern conditions.

Lviv Polytechnic National University has 17 institutes that train specialists in various specialties and at various educational levels: Institute of Public Administration and Professional Development, Institute of Architecture and Design, Institute of Construction and Engineering Systems, Institute of Geodesy, Institute of Humanities and Social Sciences, Institute of Economics and Management, Institute of Energy and Control Systems, Institute of Computer Sciences and Information Technologies, Institute of Computer Technologies, Automation and Metrology, Institute of Mechanical Engineering and Transport, Institute of Spatial Planning and Promising Technologies, Institute of Law, Psychology and Innovative Education, Institute of Applied Mathematics and Fundamental Sciences, Vyacheslav Chornovol Institute of Sustainable Development, Institute of Telecommunications, Radio Electronics and Electronic Engineering, Institute of Chemistry and Chemical Technologies

and International Institute of Education, Culture and Diaspora Relations.

Lviv Polytechnic National University is constantly improving. The professors and teaching staff actively undergo internships and trainings both in Ukraine and abroad, improve the level of foreign language skills and increase the focus of scientific achievements. An increase in the number of students is an active motivating component for improving the education quality, the involvement of the latest technologies for teaching new material, and the interest activation of education seekers in obtaining a professional specialty. There are constantly functioning laboratories, where you can try the use of practical knowledge and evaluate its impact, meaning or result based on the university. Moreover, there is an opportunity to work at specialized enterprises and to complete an internship abroad.

Conclusions and research perspectives. After considering three higher technical educational institutions in Ukraine, we can conclude that all of them provide a wide range of knowledge, they are a center of significant technical culture. Depending on the city, higher educational institutions train specialists

at various educational levels and propose various specialties. It is important to note that higher technical institutions provide an opportunity to receive not

only technical education, but also include faculties and institutes of humanitarian direction, and therefore attract even more applicants.

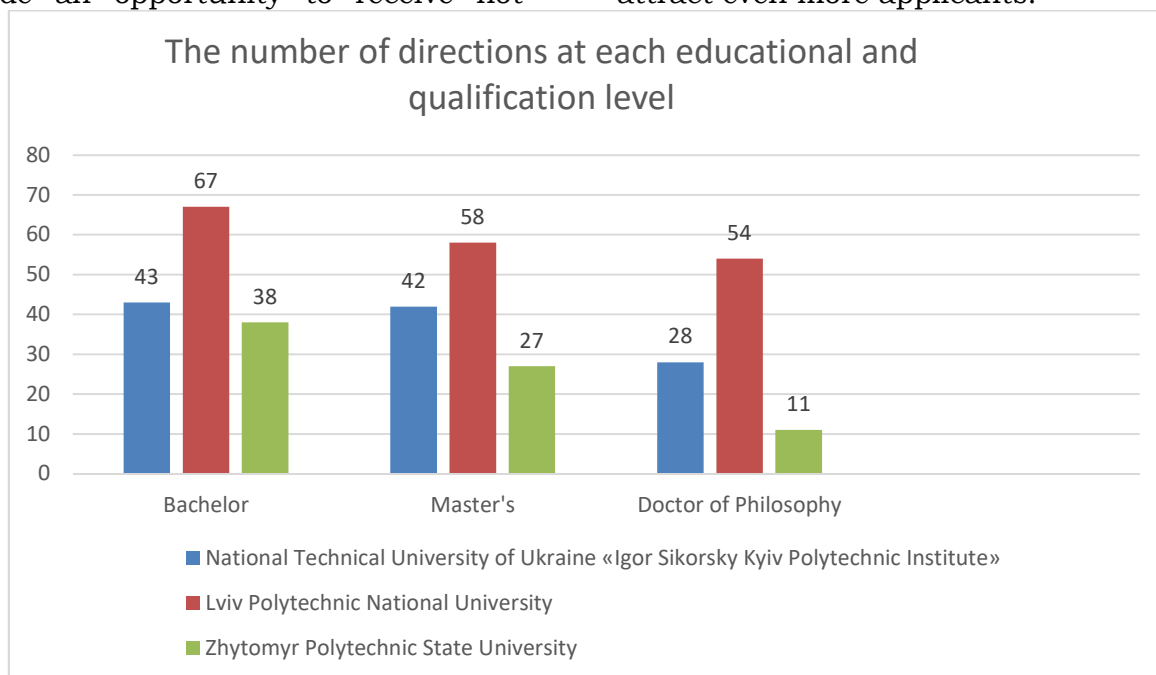


Fig. 1 Comparative figure of the directions number at each educational and qualification level [compiled by the author]

As can be seen from Figure 1, the largest higher technical educational institution is the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", which trains the largest number of specialists.

Technical education has many advantages, and it is in demand in many areas of society. The faculties and institutions of all the universities are analyzed and the possibilities of further employment are shown. It is established that specialists with technical education have the possibility of a high

employment level. The number of licenses for each educational degree is illustrated. The participation possibility in international projects and conferences is shown. It is concluded that higher technical education will be a significant advantage for a modern citizen of any state.

The perspective of further research consists in considering new faculties and modern technical specialties that would meet the requirements of today, showing their pros and cons, their development and further improvement.

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