

WORLD EXPERIENCE IN USING EDUCATION AND SCIENCE IN THE PROCESS OF BUILDING THE STATE INTELLECTUAL POTENTIAL

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World Experience in Using Education and Science in the Process of Building the State Intellectual Potential

The aim of the article is to analyze the world experience in using education and science in the processes of increasing the intellectual potential of the state and prospects of its application in Ukraine. The article describes features of the continental, Atlantic and the East Asian models of higher education management with emphasis on the key points, which can be useful for reforming the Ukrainian system of education. It has been noted that the problem of higher education quality in Ukraine lies in fundamental principles of its functioning, because development of the national education system for a long time took place under conditions of administrative system, while the European system of education is built on principles of competition and free market. On the basis of comparative characteristics of sources of finance in the United States there has been determined a dominant role of the federal government and it has been found that among the branches of science the leading positions are occupied by the life sciences. The experience of reforming science in countries of the Central and Eastern Europe, which took place on the model of functioning of the research institutes and research process in the EU countries, has been analyzed. Particular attention is paid to the successful experience of reforming the education and science in China. Taking into account the international experience the author has substantiated the directions of increasing the intellectual potential in Ukraine by deepening the integration of education and science, in particular: the creation of a wide network of research universities and conducting of a fair share of fundamental research on their base; accelerated development of public-private partnership in education and science; quick updating of the curricula adequate to the requirements of time and introduction of interdisciplinary courses; competitive financing of scientific programs with participation of the state and international financial institutions; increasing of financial autonomy of universities by attracting private financial resources through business structures, establishment of charitable investment funds; intensification of cooperation of higher educational institutions with business structures, which will contribute to further development of the institutional environment and national economy as a whole.

Keywords: education, science, model of higher education management, reform of science, development of intellectual potential

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Крупка М. И., Ревак И. А. Мировой опыт использования образования и науки в процессах наращивания интеллектуального потенциала государства

Целью статьи является анализ мирового опыта использования образования и науки в процессах наращивания интеллектуального потенциала государства и перспективы его применения в Украине. В статье рассмотрены особенности континентальной, атлантической и восточно-азиатской моделей управления высшим образованием, акцентировано внимание на ключевых моментах, которые могут быть полезными для реформирования украинской системы образования. Отмечено, что проблема качества высшего образования Украины заложена в фундаментальных принципах ее функционирования, поскольку условиями развития отечественной системы образования длительный период служила административная система, тогда как европейская система образования построена на принципах конкуренции и свободного рынка. На основе сравнительной характеристики источников финансирования в США установлена доминирующая роль федерального правительства и выяснено, что среди отраслей науки лидирующие позиции занимают науки о жизни. Проанализирован опыт реформирования науки в странах Центрально-Восточной Европы, который проходил по образцу функционирования научно-исследовательских институтов и исследовательского процесса в странах ЕС. Особое внимание обращено на успешный опыт реформирования образования и науки в Китае. Автором обоснованы направления наращивания интеллектуального потенциала в Украине с учетом зарубежного опыта путем углубления интеграции образования и науки, в частности:

Крупка М. І., Ревак І. О. Світовий досвід використання освіти і науки у процесах нарощування інтелектуального потенціалу держави

Метою статті є аналіз світового досвіду використання освіти і науки у процесах нарощування інтелектуального потенціалу держави та перспективи його застосування в Україні. У статті розглянуто особливості континентальної, атлантичної та східно-азійської моделей управління вищою освітою, акцентовано увагу на ключових моментах, що можуть бути корисними для реформування української системи освіти. Зазначено, що проблема якості вищої освіти України закладена у фундаментальних принципах її функціонування, оскільки умовами розвитку вітчизняної системи освіти тривалий період слугувала адміністративна система, тоді як європейська система освіти побудована на принципах конкуренції та вільного ринку. На основі порівняльної характеристики джерел фінансування у США встановлено домінуючу роль федерального уряду та з'ясовано, що серед галузей науки лідируючі позиції займають науки про життя. Проаналізовано досвід реформування науки у країнах Центрально-Східної Європи, що відбувається за зразком функціонування науково-дослідних інститутів і дослідницького процесу в країнах ЄС. Особливу увагу звернено на успішний досвід реформування освіти і науки в Китаї. Автором обґрунтовано напрями нарощування інтелектуального потенціалу в Україні з урахуванням зарубіжного досвіду шляхом поглиблення інтеграції освіти та науки, зокрема: створення широкої мережі дослідницьких університетів і проведення на їх базі лівової частки фундаментальних досліджень; прискорений розвиток державно-приватного парт-

создание широкой сети исследовательских университетов и проведение на их базе львиной доли фундаментальных исследований; ускоренное развитие государственно-частного партнерства в сфере образования и науки; быстрое обновление учебных программ, адекватных требованиям времени и внедрение междисциплинарных курсов; конкурсное финансирование научных программ с участием государства и международных финансовых организаций; расширение финансовой автономии вузов за счет привлечения частных финансовых ресурсов через бизнес-структуры, создание благотворительных инвестиционных фондов; активизация сотрудничества высших учебных заведений с предпринимательскими структурами, что будет способствовать дальнейшему развитию институциональной среды и национальной экономики в целом.

Ключевые слова: образование, наука, модели управления высшим образованием, реформирование науки, наращивание интеллектуального потенциала

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нерства в сфере освіти і науки; швидке оновлення навчальних програм, адекватних вимогам часу та впровадження міждисциплінарних курсів; конкурсне фінансування наукових програм за участю держави та міжнародних фінансових організацій; розширення фінансової автономії ВНЗ за рахунок залучення приватних фінансових ресурсів через бізнес-структури, створення благодійних інвестиційних фондів; активізація співпраці вищих освітніх закладів з підприємницькими структурами, що сприятиме подальшому розвитку інституційного середовища та національної економіки в цілому.

Ключові слова: освіта, наука, моделі управління вищою освітою, реформування науки, нарощування інтелектуального потенціалу

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Introduction. In the period of the deepening of international work division in the sphere of knowledge-intensive technologies, the world developed countries showed that science and education are the national priorities and competitive factors, whereas increasing the intellectual potential is the prerogative of the general national policy. The safety of state is defined by the situation in education and science, effective policy in the sphere of culture as well as spiritual and intellectual level enhancement.

Intellectual potential comes out a provision of the state economic power, guarantees its economic safety and represents its strategic resource in the global scope in the XXI century. The problem of underestimating its own intellectual potential and lack of effective means for its increasing are becoming more important for Ukraine. International experience of reforming education and science and integration processes in this area should become benchmarks for effective reforms in the above-mentioned sectors of the national economy.

Analysis of recent research and publications. Urgent issues concerning the impact of intellectual potential on economic growth and the overall level of welfare and the extent of its use in the global processes are the subject of research for domestic and foreign scientists. The issues of education and science, mechanisms of integration of science and education, aspects of the state support of educational and scientific spheres were investigated by O. Vodopianov, V. Polterovych, I. Sokolov, V. Supian, A. Fisun and others. The analysis of trends and sources of scientific funding is presented in details in international analytical reviews and reports.

The aim of the article is analyzing the global experience concerning education and science in the processes of increas-

ing the state intellectual potential and prospects of its use in Ukraine.

Presentation of the research results. A higher level of education contributes to active processes of increasing the intellectual potential later on turning into a highly profitable strategic national resource. Effective educational policy and management model in higher education play an important role in promoting high standards of higher education. Several models of educational process management in higher education are considered in international educational sphere. Continental, Atlantic and East Asian models characterized by complex forms are worth focusing on. Each of these models is conditioned by mental peculiarities of the native population, the specifics of public administration, the type of economic system and to some extent can be adapted to Ukrainian realities.

A characteristic feature of the continental model of management is the prevalence of the state influence on the higher education sector. German and French systems of higher education, which include function coordination between the corresponding bodies is a classic example of such management type. The strategic organization and coordination of public policy, implementation of the main activities and adopted programs, international cooperation, management and control in relationships with the subordinate institutions are among the tasks of the Federal Ministries in Germany. The Federal Ministry of Education, Science and Technology, the Committee on Education, Research and Results of Estimating the Technological Progress Impact in the Bundestag and the Conference of Rectors and Presidents of Universities of Germany form the higher management bodies. It is worth mentioning that the leading

role of the state in regulating the educational processes, free higher education, availability of social guarantees for the teaching staff, interdisciplinary training programs, concentration of scientific research in academic institutions, keeping close collaboration with universities are the attributes of the German education system.

French educational management model is characterized by flexible and less centralized form of management although the Ministry of Education keeps the strategic management levers. The Specialized Department for Planning and Development of Universities, which coordinates the cooperation between the state and universities plays the role of a special coordination centre. The issues of development in higher education, curricula, content of documents on education and obligatory competitive selection of lecturers are under centralized jurisdiction. The issues of material and financial support and general activity of universities are under the jurisdiction of higher educational establishments. Influential public organizations of consultant character influence significantly the functioning of the educational sphere in France together with central management bodies. The National Council and Regional Council for Higher Education and Research (CNESER) and the Conference of University Presidents are among these structures [6, p. 99–100].

We consider it appropriate to create National Council of University Rectors in Ukraine at the Ministry of Education as a consultant body (the idea is borrowed from the continental management model). It will deal with working out proposals for the strategic development of higher education in Ukraine, providing constant advice to the Committee on Education and Science of the Verkhovna Rada of Ukraine when preparing relevant legislation, working out effective measures to improve the quality of higher education, providing high-quality educational services, considering other pressing issues in accordance with adequate time requirements.

The Atlantic model of higher education is based on the principles of decentralization, democracy, university autonomy and social determination, which closely correlate with the original rules common for the American model of market economy. The education management in the USA has a pyramidal structure. Management of higher education legally and practically is carried out at the states level and includes vertical and horizontal submission. The horizontal management segment involves the participation of state, public bodies and local authorities in the educational institutions management. Management of the state sector of higher education is carried out at four administrative levels: federal (US Department of Education, American Council on Education); staff (Board of Regents, the Coordination Council, a Consultative and Coordinating Council, the Department of Higher Education); collegiate county (county council, county council executive staff); school district (board of trustees, school administration). The nature of management at each level is defined as public-state, as the influence of public decision-making in higher education is essential.

In general, the US created a diversified system of higher education, which is considered to be one of the most advanced in the world. Taking into consideration a great amount of educational institutions, American Carnegie Foundation offered to divide all US institutions of higher education into 10 groups, depending on the specifics of each institution, the number of

students enrolled, the amount of funding, the number of proposed training programs, courses, etc. Research universities (categories 1-2) are considered to be the most prestigious, offering a wide range of educational programs, training bachelors followed by postgraduate studies and are generously funded by the US government. These institutions are the core of the American system of higher education and the main centers of fundamental science. The institutions of lower categories are considered traditional universities, mainly engaged in training and educational activities and represented in a wide network of colleges and special schools [4, p. 36-38].

Fast response of the state leadership to any (even the least) exogenous and endogenous challenges is the feature of the American system of education. For example, the most pressing areas of educational development programs were included in the budget for each fiscal year and fighting terrorism, national security and further promotion of the US into the free global space were national priorities under President George W. Bush. Thus, two new programs – the Program on Increasing the US Competitiveness and the Program on Improving the Knowledge of Foreign Languages for the purpose of national security were included into the budget for 2007 fiscal year [8].

The decentralized type of higher school management is common for Canada. There is no single coordination centre and there are no national standards for higher education. Each province determines its educational policy while the federal government provides local administrations with funds necessary for the development of higher education. The Associations of Universities and Colleges of Canada (AUCC), which serve as coordination elements between universities and the Canadian government, act as Approval Body.

The example of using the Atlantic model of higher school management is beneficial to the national education system. Firstly, the absolute priority is given to research universities, which are considered to be the most prestigious and lead the national and international top rankings. Secondly, the educational institutions are centers of the highest level of fundamental education with modern scientific research base. Thirdly, there is close cooperation between universities and businesses, which contributes to the rapid commercialization of scientific ideas. Fourthly, the created associations of national universities function as advisory bodies and coordinating centers between universities, government and business.

The East Asian model of higher education is characterized by moderate influence of the state and close ties with business structures. The Ministry of Education, Culture, Sports and Technology, which initiates the development of national standards, curriculum and educational materials, carries out the general management of the education system in Japan. Simultaneous functioning of public and private educational institutions led to the creation of the National Institute of Universities Monitoring in 2000. The main task of this body is to control the efficient and effective allocation of public funds on education and research. The reform of education system in Japan aimed at restructuring of the management system, the transformation of universities into national university corporations, introduction of a system of external evaluation of universities and academic teaching staff, determining 30 leading universities in each priority area, etc. started in 2003 [12].

The hybrid nature of higher education management, which involves, on the one hand, the leadership of the Ministry of Education of China, on the other — broad autonomy of educational institutions on the core activities, is the peculiarity of the Chinese education system. The reforms of education system in China began with the adoption of the «Project 211» and «Project 985» programs, which main objective was the formation of a new concept of higher education to promote top 10 universities into the international education market [13].

To our mind, using the East Asian model of management in Ukraine is irrelevant yet, since the structure of the domestic economy does not meet the modern demands of highly competitive educational environment. This is caused by the underdeveloped business sector, lack of scientific and commercial relations between the universities and business structures, pas-

sive role of the government in promoting national top universities into the world market of educational services, etc.

The effectiveness of the above mentioned models of education management is caused, in our opinion, by high quality education and a highly competitive educational environment, which, unfortunately, cannot be said about the Ukrainian system of higher education. The problem of the quality of higher education in Ukraine lies in the fundamental principles of its functioning. The national education system was controlled by the administrative system with its typical legislative approaches and methods for a long period, whereas the European educational system is based on the principles of competition and free market. The analysis of the differences in the formation of qualitative education between national and European systems is shown in Fig. 1.

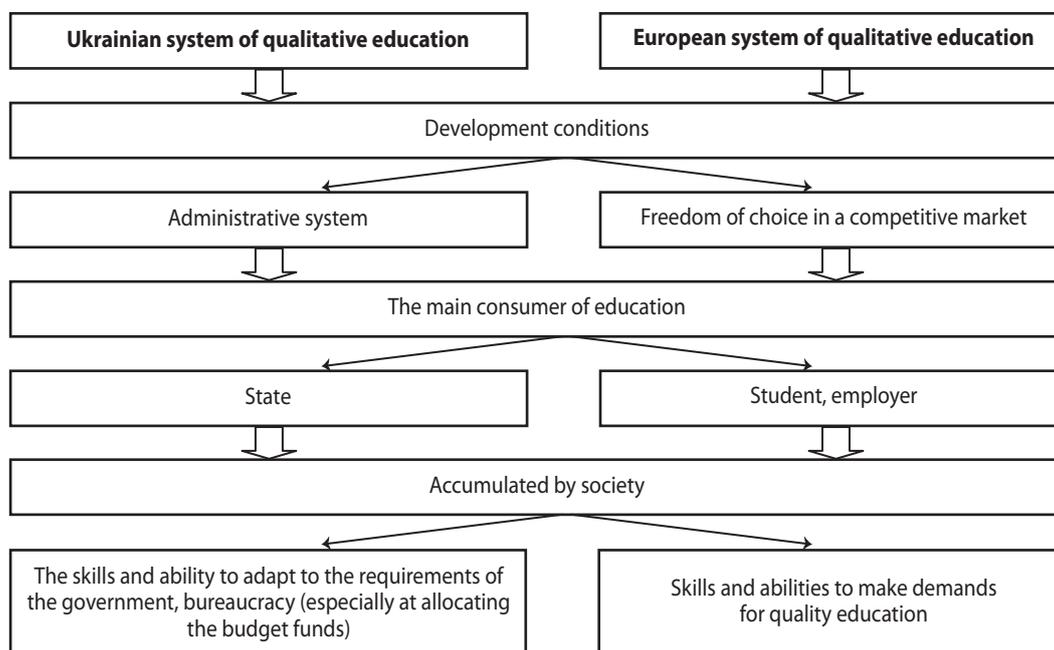


Fig. 1. Differences in the formation of Ukrainian and European systems of qualitative education

Thus, the issue of quality of higher education should be on the agenda of the newly established National Agency for Quality Assurance in Higher Education, which will deal with the formation of requirements for quality assurance systems of higher education, development of regulations on accreditation of educational programs; analysis of the quality of higher educational establishments of Ukraine; conducting of licensed examinations; creation of a single database of specializations introduced by universities; according to which students of higher education establishments are trained at every level of higher education, etc. [5].

Scientific achievements that form the basis of intellectualization of national economies in the world confirm the priority development of science in the context of economic growth and strengthening of the economic safety of every state in particular. Recognition of the scientific field as a high-performance area of the national economy and development of breakthrough in high-technical areas, which is a guarantee of success in highly developed countries of the world, lay a solid foundation of national security in general.

The process of formation and development of scientific schools in the USA, Western and Central Eastern Europe is based on the national legal framework taking into account ethnic, mental, cultural and spiritual traditions of every nation. In recent decades, the highest efficiency of investment in science is seen in the United States, which hold leading positions in scientific research financing. The USA annually increase the gross expenditures on research and development (R & D). According to the World Bank, \$ 465 billion were spent on R & D in 2014, \$ 450 billion were spent in 2013 and \$ 447 billion were spent in 2012 representing 2.8 % of the value of the GDP [18].

China with its annual GDP having grown 1.07 times and the amount of gross expenditure on R & D 1.01 times holds the second position in the ranking (Top 40). The stable growth trend in the national economy of China makes it possible to annually increase the share of GDP that is intended for research funding, having spent up to 1.5 % of GDP on R & D in 2008, 1.8 % of GDP in 2012 and 2.0 % of GDP in 2014 [11; 18].

Ukraine holds the 39th position in the world ranking of the top 40 with the unchanged 0.9 % of GDP and \$3 bln gross expenditure on R & D annually during 2012-2014 [18]. The same share of the GDP on research has Lithuania (0.9 %), a slightly lower one have Poland, Slovakia, Croatia and Greece (0.8 % of GDP) [16].

The National Science Foundation is the institution responsible for the development of scientific research in the USA and it finances research and educational programs in many areas of science and engineering. The institution has established cooperation with more than two thousand colleges, universities, businesses and informal science organizations through grants and cooperative agreements. Each year the Foundation receives about 40 thousand proposals for conducting research, educational and professional training; one out of four is funded [10].

Research funding in American universities is carried out on the basis of various sources, including funds from the federal government, state and local budgets, institutional foundations, businesses and non-profit organizations. It should be noted that funding is growing and in 2013 reached \$67.2 bln [9]. The largest share of financing is provided by the federal government — 58.9 % or \$39.5 bln and the US institutional funds provide 22.3 % or \$15 bln. Approximately the same financial share is sponsored by non-profit organizations (\$3.9 bln), state and local governments (\$3.7 bln), business organizations (3.5 bln) [9].

The increasing role of the individual in the socio-political and economic life of society, which is observed since the mid-twentieth century, helps to attract the attention of researchers to the problem of a harmonious unity of man and the world including proper human's behavior in the biosphere in general. In this regard, life sciences are particularly popular because of a peculiar ability to influence the processes associated with improving the quality and standards of living. Applied application of the research results in this segment takes place in the health care sector, medicine, pharmaceutical and food industries and agriculture. Gross expenditures on research of life sciences at American universities in 2013 reached the share of 56 % of the total expenditures of \$ 37,6 bln on all R&D. Financing of engineering was \$10.7 bln (16%), natural sciences received \$4.7 bln (7%), social sciences — \$2.1 bln (3.2 %) [9]. The Ministry of Health and Social Security (the service sector) is a leader among the ministries and agencies that fund university research spending 54 % on R&D, i.e. \$21 bln [9].

The scientific power of leading universities in the US confirms the key role of science in terms of adding intellectual potential, which is aimed at solving the pressing problems of human civilization. We can confidently claim that the problem of how to guarantee the safety of the individual and society as a whole is in the focus of leading scientific schools.

In our opinion, the experience of science reformation in Central and Eastern Europe (CEE) should become a good example for the renewal of the national system of science and enhance its role in the process of building an efficient market economy. Ukrainian science with its underestimated potential is at the forefront of intellectualization of the national economy and economic security strengthening.

The strategy of scientific development in the CEE region was created in the EU-15 countries on the model of functioning of research institutes and research process in general, and its implementation has been lasting for over 20 years. It is worth mentioning that the reform of science in each CEE country has its own characteristic features, advantages and disadvantages, which to some extent are useful for considering the similar process in Ukraine. Thus, the process of restructuring the Polish system of science began in 1991 with the creation of the Committee for Scientific Research, which received the right to manage all budgets. The management of the committee was appointed by the parliament itself and mainly dealt with the protection of research and development areas. Today the achievements of Polish scientific schools are recognized throughout the world and Poland's share of publications in nanotechnology is higher than that of such EU member countries as Austria and Ireland, and it is slightly lower than the figures for Belgium and Spain; the overall expenses on the basic research reach almost 40 % of total expenditures on research and development, which is considered to be one of the highest in the world [3, p. 54]. Poland belongs to the sector of «very high human development» according to the degree of human potential development and ranked 35th with the index 0.834 in 2014, and Poland's rating is growing every year [17].

The Czech Republic began the process of science reforming in 1993 by the formation of the Academy of Sciences of the Czech Republic on the basis of independent research institutes. Organization and conduction of scientific research is carried out not only by the Academy of Sciences, which is considered to be a leading research center, but also by the research potential of the university community. The funding of research and development significantly increased during the period of reforms: from 1.2 % of GDP in 2001 to 1.4 % in 2008 and to 1.8 % of GDP in 2013 [16].

The reforming of science in the Czech Republic has, in our opinion, a few positive aspects. Firstly, the government provides more and more funding for programs motivating young Czech scientists to stay working in their home country; secondly, it stimulates teaching academic disciplines in English, thus, expanding the scientific and educational sphere to attract foreign students; thirdly, the Ministry of Education and Science of the Czech Republic is launching Navrat (Return) program aimed at returning the country's leading scientists, who immigrated abroad. The implementation of the program is expected to be completed till 2019 [3, p. 52].

In our opinion, each of the above mentioned steps can be used as a recipe for the National Academy of Sciences and the Ministry of Education of Ukraine to carry out effective reforms in this area and further concentrate scientific forces on increasing the national intellectual potential.

The elimination of academic science and conducting research in the leading universities is a characteristic feature of the reform of scientific schools in the Baltic States. In Estonia, scientific work is carried out at university institutions, research centers and institutes subordinate to the state. The Estonian Academy of Sciences is represented by the association of scientists. Its task is the development and representation of Estonian science, assistance in the applied use of the research results to increase the quality of life. The Academy provides

independent expertise and professional advice, participates in the preparation of legislation relating to research activities and coordinates the scientific work in Estonia and at international level [1]. Lithuanian Academy of Sciences is a budget institution that brings together the most prominent Lithuanian and foreign scientists, whose work is related to Lithuania. University research institutes and government research institutions carry out the scientific research activity [2].

The Baltic States formed their basic principles of science and technology development at the beginning of 2006 and they are still topical today: the rejuvenation and development of human resources and infrastructure; transformation of universities into competitive international research centers; strengthening of the competitiveness of domestic researchers in international market and development of international research cooperation; improvement of innovation transfer from science to industry [3, p. 53].

The experience of China is a striking example of the recognition of education and science as the priorities for economic development. In 1997 the Chinese government announced a state official program under the slogan «Science and education will lead the country to prosperity». This program acquired the status of a national idea and the number «211» was chosen for the program of education where the first two figures meant the XXI century and the last meant the first hundred of elite universities. The ambitious plan of the Chinese leaders to increase the ranking of national universities so they could get into the world rankings seemed impossible due to low literacy of the population. For example, there were about 50 students per 10 thousand people in China compared to 500 students in the USA per capita, the GDP in China was \$ 750 while in the USA it was \$33 thousand; i.e. the total budget of higher school in China can be compared with the costs of Harvard, Oxford and Cambridge universities [7, p. 88]. Today the picture is radically different: according to the World Bank the GDP per capita in China is growing annually and in 2014 reached \$7,593.9 and in the US the figure was \$54,629.5. Over the last few years three Chinese universities, including Beijing, Sichuan and Fudan joined the world universities Top-100 [15; 14]. In general, international experts agree that the educational reform in China today is the largest event in this area at a global scale.

China's experience without doubts shows how the national policy and properly placed accents can serve as a stimulus for economic growth and prosperity of the country.

Conclusions. Thus, the integration of education and science, which was effective in the world developed countries and can be successfully used in Ukraine, in our opinion, consists of (or should consist of): formation of a broad network of research universities and conduction of research on their basis; fast development of public-private partnership in education and science; fast updating of training programs with modern requirements and introduction of interdisciplinary courses; research programs funding on competitive basis involving state and international financial institutions, increasing financial autonomy of universities by attracting private funds from businesses, creation of charity investment funds; intensification of cooperation between higher educational institutions and business structures with further development of

the institutional environment and the national economy as a whole.

We are confidently that introduction of continuous education for every citizen, the widest possible access to knowledge at a reasonable price, development of higher education institutions focusing on the current needs of the market, expanding of scientific collaboration with the business sector, formation of associations aimed at development of qualification requirements for specialists of a certain field and the content of individual training programs, solving urgent problems of home universities, etc. will be useful for Ukraine.

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