

# Scientific and educational leadership factors and the competitiveness of Ukraine

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**Abstract** This paper is devoted to discussing the influence of leadership factors of higher education and science on the formation of a society that seeks to develop a competitive economy in Ukraine. One of the characteristic features of the modern world is the transformation of information and knowledge on the critical resource of economic development, which is evidence of the need to create favorable conditions for the development and implementation of innovative ideas and technologies.

The inclusion of scientific and educational components in the reproductive process of the activity of the smart society and its active participation in socioeconomic development with the focus on advanced production technologies requires in-depth study of innovative approaches to the quality of higher education and science. Taking into account the scientific and educational factors that influence the implementation of the principles of the formation of a competitive economy of Ukraine and the sustainable development of society, we perceive these challenges as a significant problem for Ukraine at the present stage of creating a European educational space.

## 1 Introduction

Nowadays, in modern economic and social conditions, the inclusion of scientific and educational components in the reproductive process of the activity of the smart society and its active participation in socioeconomic development with the focus on advanced production technologies requires in-depth study of innovative approaches to the quality of higher education and science. The importance for the implementation and promotion of innovative activities becomes national innovative system developed innovation infrastructure and its degree of integration into the global network of information and technological flows. Pulses for uninterrupted and smooth functioning of the national innovation system are its high-quality educational and research components (Naushad 2018; or Radwan 2018). The quality of higher education and research is crucial for a society that tends to move towards a competitive economy with a focus on advanced manufacturing technologies and processes (Mishra and Singhania 2014). Today, economic globalization requires the preparation of highly educated workers who are able to perform complex tasks and adapt to a rapidly changing environment (Volchik et al. 2018). It is in higher education forming future developers of new progressive ideas and innovation, and also professionals who will develop and refine the technology in practice that contribute to the technological development of industries and the economy as a whole (Strielkowski 2018).

Therefore, an analysis of factors determining the quantitative and qualitative status of national education, as well as their dynamics is essential for understanding the driving forces in shaping the competitive economy of the country. That this is due to review the relevance of the problem.

Our paper is intended to justify the essence of the competitiveness of higher education, to identify the problems and promising directions of raising the level of competitiveness of the subjects of higher education and science

on the formation of a society that seeks to develop a competitive economy in Ukraine of inclusion of scientific and educational components in the reproductive process of the activity of the smart society. During the research, the following scientific methods were used: analysis and synthesis (to identify the problems of ensuring competitiveness), theoretical search and abstract-logical (to characterize the essence and characteristics of competitiveness of higher education), structural and structural-functional analysis (for carrying out the strategic directions for the development of competitiveness of higher education and identify mechanisms for converting information and knowledge on critical resource of economic development and basic factors explain the significance of education and science to further improve the competitiveness of Ukraine's economy).

## **2 Literature review**

Solving the problems of incorporating scientific and educational factors into the development of economic theories of reproduction and building a competitive economy and improving social and industrial relations in social and economic systems are devoted to the work of specialists in the field of education, science, and economics (Bogdanović et al. 2018).

Trends in economic and social developments in a globalized world economy shows gradual dominance of post-industrial society with characteristic changes in the structure of production and service resources and specifics of the labor force (Bell 2004; Čábelková et al. 2015; or Bordea et al. 2017). Despite deep enough processed the specific features of each of these areas build competitive national innovation system, in our view, require complex analysis in terms of causality, quantitative and qualitative characteristics of higher education and science in Ukraine, determine their dynamics and sources of formation. Whiddett and Hoolyforde (2000) distinguish the following competencies: business development (personal development, idea generation, and justification); achievement results (planning, clarity in management decisions, goal setting); analysis (working with information); human resource management (teamwork, relationship management). An important task is the need for performance evaluation system of science and education in Ukraine compared with the best international standards. One of the objectives of the study is to evaluate the recent changes in the dynamics of events and indicators characterizing an educational component in the context of international competitiveness of these sectors and the economy as a whole (Stojanov et al. 2011). This is seen by the example of the economic laws of reproduction underlying social and economic development.

Porter (1990) showed how important is the link between the quality of higher education and the competitiveness of the state. Altbach (2016) considered contemporary problems and prospects for the development of higher education. Lane (2012) showing that universities are an important part of the country's economic development. Lopez-Leyva and Rhoades (2016) viewed the performance of global competitiveness and higher education competitiveness between two groups of countries. Bagmet and Liakhovets (2017) viewed the analysis of study results concerning the attitude of the population of Southern Ukraine to the European Union and willingness to implement the European education standards at higher education institution. Duřová Spiřáková et al. (2016) analysed and assessed the level of achievement of these two sub-objectives in the Member States in 2014, with the emphasis on the southern countries of the European Union as well as to estimate the the degree of fulfillment, respectively failure of the target values until the year 2020. Androniceanu and Ohanyan (2016) reviewed approaches to monitoring the quality assessment of higher education. Kupets (2015) emphasized the hybrid inefficient version of education with the old Soviet traditions of centralized management and inadequately implemented European standards autonomous management and the principles of the Bologna process. Many works of these authors also investigated the matter and the formation of high-quality education system, assessed the status and trends of the scientific part of the national innovation system. Problems of education that would meet the highest international standards (Strielkowski 2017). These problems require further research that influenced the formation and purpose of the study shows its timeliness and relevance. Inclusion of scientific and educational components in the reproduction process activity smart society and its active participation in the socio-economic development with a focus on advanced production technology requires in-depth study of scientific approaches to the analysis of the quality of higher education and science.

## **3 Results and outcomes**

One can see that higher education in Ukraine has always occupied a special place among the living standards of people in planning their future. If you look at the evolution of higher education in Ukraine, we can isolate certain periods of its formation. Thus, in early 1990s, independent Ukraine received the highly educated population with a dominating respect to education as one of the basic values. Even if the small funding for education over the next decade the proportion of the population with higher education increased. At this time, begins to fight for survival public universities, private universities there. Universities become "forge" diplomas low quality of the

students' knowledge and high corruption. Since the 2000s began reforming higher education in order to improve its quality. Thus, in 2005. starts approaching the evaluation system in universities to European standards and the Bologna Process. But the result was an inefficient hybrid version of the old Soviet educational tradition of centralized management and adequately implemented European standards and principles of autonomous management of the Bologna process (Kupets 2015). The current state of higher education in Ukraine, on the one hand, the dynamics can be described through the annual number of entrants and universities (Table 1).

**Table 1.** Dynamics of universities and students in Ukraine in 2010-2016

Indicator	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016
The number of students in higher education I - IV accreditation, thsd.	2418.1	2246.4	2106.2	1992.9	1689.2	1,605.27
Number of universities I - IV accreditation, ed.	813	805	785	767	664	659
The average number of students per one school, people	2974	2791	2683	2598	2544	2436
The number of students per 10,000 population	557	519	488	463	393	375

Source: Own results

For so many university students and one university in Ukraine an average of 2.5 thousand. Students. In Poland, for example, in the 2013/2014 academic year, the number of students was about 1550 thousand. People who studied in 438 universities (Higher education institutions and their finances in 2013). It means that an average of one university accounted for 3.5 thousand students.

Dynamics of total institutions by ownership with respect to the years 2010/2011 showed that six years analyzed their total number decreased by 18.9%, with marked reduction level equally inherent in both state and private universities. However, the number of private universities has decreased over this period by 23.1% and the government - by 17.6%. If we compare the ratio of Universities by ownership, in Ukraine significantly dominated by the number of public universities. Thus, in 2016 their share was 72% (State Statistics Service of Ukraine 2018). In Poland, to compare public universities account for only 28% and in Georgia – about 24% (National Statistics Office of Georgia 2018).

The structure of the number of universities in Ukraine in terms of accreditation shown in Fig. 4. Level of accreditation shows the capacity of higher education institution to carry out a certain type of educational activities related to higher education and training. I-II levels of accreditation are university technical schools, colleges and other equivalent higher education. III-IV accreditation level institutions - it institutes, conservatories, academies and universities. In 2016 they were distributed, respectively, 56 to 44% with slight advantage in favor of the universities I-II levels of accreditation.

The share of students enrolled full-time studies and recent increases in 2016 is 71.1%. In addition to evening and distance learning in Ukraine began development of distance learning. In the West, this form was already a long time and is very popular among students. The need for professional development or expansion of activities causes need quickly and efficiently learn new knowledge and skills, that's when the best form is distance learning.

Enrollment in Ukrainian universities gradually decreasing, reaching in 2015/2016, nearly 1,605.27 thousand students 33.6% less than in 2010/2011. Trend shows that the number of university students in six years annually decreased to 167.12 thousand students (State Statistics Service of Ukraine 2018). One of the reasons specified speakers are reducing the number of potential students due to demographic changes in Ukraine (Safonov 2010). The value of this indicator since 2006 has exceeded 100%, ie the university more people entered than left school in the relevant year. This situation is explained by the fact that among incoming students also take into account part-time and evening forms of training, which often come Applicants who left school in previous years have or obtain second education. Some reduce the proportion of applicants seen in 2008 and 2009 when it was announced the passage of testing as a mandatory condition for admission to universities. Markedly reduced the number of applicants in 2011, due to the fact that due to the passage of 11 to 12-year secondary education in this year students had to finish school, another year continued their studies. According to the forecasts of the population of Ukraine starting from 2019 can be expected again increasing the number of entrants to higher education.

Among the sources of funding for training students in Ukraine is the main state budget and individuals. In the years 2015/2016 slightly dominated by the state budget, their share in total funding was 45.6%, is 7.3 percentage points more than in 2010/2011, respectively (State Statistics Service of Ukraine 2018).

Rapid economic growth primarily is due to the unique technical innovations that are necessary to maintain and develop. Modern production facilities requiring highly skilled professionals in STEM-education (Science, Technology, Engineering, and Mathematics), so there is a need in the teaching and learning of mathematics in the education system. In Ukraine, the share of STEM graduates in 2015 was 9.8%, is higher than in Poland (6.8%) and Hungary (6.3%). In South Korea university programs of technical skills intensive state-sponsored and engineering students get much more benefits (both financial and in terms of further opportunities of employment) than the humanities. Social Sciences and Humanities taught mainly at private universities.

Equally important in the formation of a competitive national innovation system gets creating conditions for effective development of scientific sphere countries. In our country the scientific field, as well as educational exhibit the same negative situation. And if progress can be seen, only on certain quantitative indicators. And not always increase quantitative assessment leads to higher quality. So, if increasing the number of graduate and doctoral students, the increasing number of institutions Postgraduate efficiency last remains very low. Thus, in 2016 481 educational and research institution had graduate school, whose effectiveness by the number of protected theses for the last five years is about 25%. The highest percentage of protected theses demonstrate medical sciences (62.4%), military science (45.5%) within 30-33% - philological, geographical, legal, educational, political science, and physical education and sports. Among the lowest - agriculture (12.1%) and veterinary (5.6%) Science and Arts (9.8%). Efficiency doctorate for 2010-2016 years. Ranges from 26 to 33%. The largest proportion of protected theses also observed in health sciences (63.6%), legal (47.6%) and philological (41.7%). The least effective - doctoral students in public administration (13.6%) and physics and mathematics (14.3%).

The trend in the annual percentage increase of applicants from potential applicants, on the one hand, looks like a positive trend, increasing the proportion of people with higher education. On the other hand, professional structure and the quality of education does not meet either international standards or demands from the domestic business, ie the potential labor market of graduates.

British company QS SAFE National System Strength conducted a research project entitled "Rating of the best system of higher education (Top 50)". This rating is an attempt through ratings and other indicators to assess not individual universities and all higher education system of the country as a whole. According to the rating of Ukraine in 2016 was at the 45<sup>th</sup> place (RIA 2016).

About 82.5% of Ukrainian population has high school diplomas. Overall, Ukraine ranks 7<sup>th</sup> in the world in terms of population with higher education. People with university diplomas we have more than of Denmark, New Zealand and Austria. Proof of failure to request such a number of specialists with higher education serve as the results of the study, according to which the average Ukrainian evaluate the quality of higher education - 55.2% of respondents. Less than 15% of the population consider Ukrainian education to be really high quality, 58% of Ukrainians believe that a graduate degree makes it impossible to find a good job.

Among the respondents about the basic qualitative characteristics of higher education in Ukraine only 35.2% agree that the Ukrainian education provides good training, 36.4% indicate that it can be realized talented and only 19.8% of respondents believe that education provides to find a good job

The issue of quality of higher education, more than ever, it is urgent. According to Art. 1 of the Law of Ukraine "On education" quality latter is defined as "a person acquired level of knowledge, skills and other competencies that reflect its competence in accordance with the standards of higher education". From the definition it is clear that the "responsibility" entrusted to the quality standards of higher education, which in Article 10 of this Law *tlumachyatsya* as a set of requirements for the content and results of educational activities higher education and research institutions, developed according to the National Qualifications Framework. These standards are formed according to claim 6 c. 13 of the Law, Scientific and methodical council with the National Agency for Quality Assurance in Higher Education and scientific-methodical commission, composed of representatives of the state, employers and their associations, institutions of all forms of ownership, scientific and other institutions. One of the principal conditions for improving the quality of education in that process of setting standards have to be a real connection qualification requirement of the modern business environment and control the formation of these competencies in university graduates. Such control can be carried out in the form of independent testing scientific and professional expertise to international standards. Stimulating to higher education quality function can perform independent monitoring research universities, as well as objective, independent ratings of Ukrainian universities. One of the principal conditions for improving the quality of education in that process of setting standards have to be a real connection qualification requirement of the modern business environment and control the formation of these competencies

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In Ukraine, due to underfunding of science and bureaucratic obstacles decreases the number of applications for patents. First, the inventors of registered international patents abroad, based on the fact that it is easier to avoid going through all the stages of Ukrainian bureaucracy. Moreover, in this case the inventor receives a bonus of enhanced action of the geography of intellectual property rights in the invention. Thence, Ukraine over the past 20 years spent 20% of inventions. Second, the best minds Ukraine continue to migrate to developed countries - where their work is valued and paid more. Thence, registered patents are also missing.

Another indicator of trends in science dynamics proportion of expenditure on research and development (R&D) in GDP, which shows a reduction in funding for 16 years at 40% In spite of the trend, it is unacceptably low rate of interest. Thus, in 2016 the R & D was allocated 0.7% of GDP, while in developed countries is 3% reference point (eg, Germany and Finland - 2.9%, China - 2.1%), and some countries spend about 4% (Israel - 4.3%, South Korea - 4.2%, Japan and Sweden - by 3.3%) (World Atlas 2018).

Many countries have long changed the system of budgetary financing of science and put a large share of the costs on the shoulders of "non-budget sector" - private enterprises. The budget of a single country among the world's most powerful states and much less developed lion's share of research and innovation funded business. Moreover, countries with roughly the same budget allocation for research in comparison with Ukraine (at 0.7% of GDP) have significantly higher citation rates and the number of internationally recognized publications.

Examples of successful financing strategy research activities is Israel. Today the country spends 4.3% of total GDP on research and development and research - and this is the highest indicator among developed countries. Interesting is the fact that the state could afford to innovate spent only 0.5% - that is little more than a tenth of the total volume of GDP (about three times less than the average in developed countries). The remaining funds will invest in Israeli science and foreign business partners.

Table 2 shows that there is a correlation between the level of science funding as% of GDP and functions played by science in society. Apparently, if the country spending on science does not exceed 0.4 percent of GDP, its scientific potential can really realize only a social and cultural function. Increasing this parameter allows for the development of certain areas of research, the results of which have the chance to be marked by the world scientific community, ie to implement cognitive function of science. Only after crossing over the threshold value of this indicator the country has sufficient scientific potential, can count on a real transition to an economy of innovation type.

**Table 2.** The dependence of the functions of science in society, the level of funding

The level of funding for science (% of GDP)	less than 0.4% of GDP	less than 0.9% of GDP	more than 0.9% of GDP
The function of science in society	sociocultural	cognitive	economic

Source: Malitsky et al. (2006)

Quite logical in today's realities of Ukrainian science is the fact that the performance of individual work catastrophically low, every scientist in Ukraine published 10 times fewer articles than the average in developed countries and it is given not only internationally recognized journals, but 60 professional Ukrainian media, the quality of which is highly questionable.

If we choose the basis for comparison of the leading world powers, Ukraine, with its situation in science is completely unattractive, each of the "Big Seven" (G7) published at least 20 times more scientific papers than Ukraine, the United States - nearly 100 times. Over the past 20 years the share of Ukrainian papers fell from 0.5% to almost 0.3% of the world total.

Another common criterion for evaluation of research activities have impact factor (from the English. "Impact" - effect) that is often used in international research practice. It displays overall citing articles in leading journals indexed all the same scientometric database Thomson Reuters Web of Science: the higher the number of links to the article, the more powerful and better scientific work of the researcher. For statistical comparison of various countries for their influential publications scientists commonly used weighted impact factor, averaged for all research. Global impact factor in all sectors is 1. The result of stagnant Ukrainian science is very low

impact factor, only 12% of all scientific works of domestic scientists come to the most advanced international magazines (the EU - 30% in the US - 40%) and is mainly articles published in collaboration with foreign partners. As a result, scientific works written by Ukrainian scientists in collaboration with Western scientists have much impact factor higher than one.

The absolute, most professors in Ukraine has zero impact factor of their research (do not cite their jobs, leading scientific centers were not invited, they did not act with plenary presentations at international scientific forums and are not members of the editorial boards of leading international publications).

The effectiveness of research and education component of the innovation infrastructure can also draw conclusions, based component of the Global Competitiveness Index of the country. For specific rating in 2017-2018 years. Ukraine ranked 81<sup>st</sup> place out of 137 countries, which is four positions lower than in the previous rating introduce that in 2016-2017.

**Table 3.** The positions of Ukraine and some countries in the Global Competitiveness Index (GCI)

Country	Years					
	2012-2013 (144 countries)	2013-2014 (148 countries)	2014-2015 (140 countries)	2015-2016 (140 countries)	2016-2017 (138 countries)	2017-2018 (137 countries)
Ukraine	73	84	76	79	85	81
Georgia	77	72	69	66	59	67
Turkey	43	44	45	51	55	53
Russia	67	64	53	45	43	38
Poland	41	42	43	41	36	39

**Source:** World Economic Forum

Table 4 shows that follows the position of Ukraine on the Global Competitiveness Index for the last three years. Despite a slight improvement, this year we are still the worst position to assess the macroeconomic environment (121 seats), for the goods market efficiency (101 seats), the development of the financial market (120 seats), according institutions (96th), with compliance with the requirements of modern business (90 seats).

**Table 4.** Global Competitiveness Index and its components Ukraine

Composite index	Place in the world		
	2015-2016 (140 countries)	2016-2017 (138 countries)	2017-2018 (137 countries)
<b>Basic requirements</b>	101	102	81
- Institutions	130	102	96
- Infrastructure	69	75	78
- Macroeconomic Environment	134	128	121
- Health care and primary education	45	54	53
<b>performance Amplifiers</b>	65	74	70
- Higher education and training	34	33	35
- Goods market efficiency	106	108	101
- Labor market efficiency	56	73	86
- Development of financial markets	121	130	120
- Technological readiness	86	85	81
- Market size	45	47	47
<b>Innovation and improvement factors</b>	72	73	77
- Compliance with the requirements of modern business	91	98	90
- Innovation	54	52	61

**Source:** World Economic Forum (2018)

In general, Ukraine has improved its position by 7 of 12. Most components lost (minus 13 points) component "Labor market efficiency." The trend towards deterioration has observed in studies last year, with those in last year, we downgraded him its position by 17 points. Also, Ukraine suffered losses estimated innovation component indices - ("minus" 9 points), infrastructure ("minus" 3 points) and a component that characterizes higher education and training ("minus" 2 points).

Negative factors for doing business in our country is defined (in descending order): inflation, corruption, political instability, high tax rates, the complexity of tax laws, government instability, difficult access to financing, inefficient government bureaucracy, regulation of the currency market, lack of education workers poor labor ethic, lack of ability to innovate, restrictive labor market regulations, inconsistent quality of infrastructure, crime and theft, poor quality health.

Identify the major driving forces in education and science in shaping the competitiveness of Ukraine is possible, assessing the performance given in Table. 5. In the years 2017/2018 Ukraine improved its position compared to the previous year deposition for secondary education, the quality of management schools, the availability of specialized research and educational institutions and degree of training. The best value we have for admission to institutions of higher education (16<sup>th</sup> place), but it is a quantitative measure that does not reflect the quality of education. For other indicators Ukraine worsened its position. The most significant decline occurred in part of Internet access in schools - 9 positions.

Among the components of the evaluation of higher education and training compared to the previous year we have worsened their position on the quality of education (49<sup>th</sup> place against 46<sup>th</sup> in the previous year) and in terms of education (16<sup>th</sup> place against 11<sup>th</sup> in the previous year) and improved by a component of training in the workplace (68 place against 77 in the previous year). Overall, higher education and training Ukraine occupies 35<sup>th</sup> place in the ranking and is two positions lower than last year, but five positions better than in 2014/2015, respectively.

**Table 5.** Global Competitiveness Index of Ukraine (2014-2018)

Components of the index related to education and science	2014-2015 (140 countries)	2015-2016 (140 countries)	2016-2017 (138 countries)	2017-2018 (137 countries)
<b>Higher education and training</b>	40	34	33	35
<b>The share of education</b>	14	14	11	16
- Enrollment in secondary education	41	39	53	51
- Enrollment in higher education	13	14	11	16
<b>quality of education</b>	65	46	46	49
- Quality of education system	72	54	56	56
- Quality and Mathematical Science study	30	38	27	27
- Quality management schools	88	87	93	88
- Internet access in schools	67	44	35	44
<b>Learning on the job</b>	88	74	85	79
- The availability of specialized research and educational institutions	84	78	77	68
- The degree of training	92	74	94	88

**Source:** World Economic Forum (2018)

The approval of high-tech industries Development Strategy by 2025 and approved plan for its implementation examined the relationship that exists between an index of human capital and GDP per capita. As one can see the relationship between these parameters is quite dense, indicating that education serves as a basis for the creation of wealth and the right development strategy-based education and training can provide the country's well-being and sustainable development. Research and education are critical factors in the development of any society, will provide formation and development of national innovation system of the country especially in the context of the fourth industrial revolution, as is the development of new technology platforms that bring together supply and demand and break the existing economic structure.

Today there is a sharp increase in demand for skilled workers and reduce the need for workers with low skills. In the near future, to be qualified in the labor market, one must be able to adapt to changing situations and to develop their skills in accordance with progress in this crucial role will be played by education and research.

## 4 Conclusions

Overall, we can conclude that building a competitive economy in Ukraine in current conditions depends on the efficient functioning within a single system, each component of the national innovation system. The unsatisfactory state of Higher Education and Science of Ukraine, in our opinion, is the result of a historical evolution of the existing and inefficient state regulation in this sphere. Among the prevailing trends in higher education can mention the reduction of entrants to higher education resulting from demographic fluctuations, insufficient quality of education received by university graduates in the background unreasonably large number of educational institutions.

Higher education in Ukraine since independence held certain periods in its formation, during which determined its specific social and economic processes in the country. So, the education system has gone from fundamental standards through uncontrolled financial self-sufficiency to the modern hybrid version of ineffective education from the old Soviet tradition of centralized management and some standards implemented European educational space.

Unsatisfactory state of scientific areas associated with both unrealized and often lost, potential domestic science, with low funding this area, which is 4 times is less than in developed countries. Therefore, it is more

appropriate to concentrate efforts on analyzing the causes and factors of the quality of the scientific and educational sphere in Ukraine in order to achieve its positive dynamics. Is inefficient and its functioning, as evidenced by the low level of productivity postgraduate and doctoral when on average only every fourth research comes to fruition. Low is also the level of innovation and the technologies and processes in the industry.

However, problems in the system of Ukrainian science and education, lack of Ukrainian universities in the Top-100 best Institutions of higher education world and low international rankings components of the national innovation system, in our view, should not be seen as an excuse "debiting" of our higher education and research, as world leaders are like the "other weight" and therefore better concentrate on analyzing the causes and factors impact on the quality of scientific and educational sphere in Ukraine to achieve its positive dynamics.

The analysis of the characteristics of higher education and science of Ukraine and their dynamics makes it impossible to obtain detailed information on the totality of the factors influencing the current state and development prospects. These issues require further study on incentives and find ways to improve the quality of national education on the part of state bodies.

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