“Assessment of intellectual leadership under global competition”

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ASSESSMENT OF INTELLECTUAL LEADERSHIP UNDER GLOBAL COMPETITION

Abstract

The formation of knowledge economy issues of leadership is being actualized in today's global environment under the influence of globalization. An important aspect is the provision of subjects of various levels of intellectual leadership, which means achieving a high position in the competition due to high quality and intensity of the implementation of intellectual resources. The purpose is to justify methodological approaches to the assessment of intellectual leadership and to analyze its manifestation at the level of intellectual resources. The object is the processes of competition and achievement of intellectual leadership of countries in the global environment. The methodical approaches to the evaluation of intellectual leadership of different subjects at three levels (resources, results, outcomes) are offered. The intellectual leadership of countries at the level of resources is empirically analyzed by using the methods of comparative, system-structured, quantitative and qualitative analysis.

By the level of intellectual leadership of the first order (accumulated intellectual resources), 32 countries have been identified as leaders, including highly developed countries and emerging active players. The unconditional leaders are the United States and China, whose relative figures are lower due to the large GDP and the population. Norway and Sweden have the highest presence in all TOP lists (6 indicators), in the second place – Finland and Switzerland (5 indicators), Australia, Brazil, New Zealand at all share the third position (4 indicators). Developed countries are predominantly leaders in terms of the formation of intellectual leadership. Outsider countries get on the list of leaders by individual indicators.

Keywords intellectual leadership, leadership, knowledge economy, intellect, human capital

JEL Classification I23, I25

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INTRODUCTION

Complex transformation processes take place in today's global environment under the influence of globalization and the formation of knowledge economy. Changing general conditions of economic activity, formation of qualitatively new trends of networking and technology are accompanied by aggravation of competitive struggle at all levels, rapid change of competitive positions, significant stratification of the competitive environment, change of rules and methods of competition. Given the increasing interdependence and interpenetration of national economies, these new trends require the attention of diverse actors in the global economy to new phenomena and many economic and managerial processes.

In such highly competitive conditions, an important task for different actors is not merely the achievement of economic development, but, first of all, the achievement of leadership positions. Leadership is becoming a competitive advantage and not only a goal, but also an instrument of competition that can bring even greater gains. Identification of leadership becomes relevant for actors of different levels: as individuals (in politics, business and other circles), as well as companies, universities, regions, national economies.

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The key factors of development, competitiveness and leadership are increasingly intellectual factors, which is explained by the acceleration of the overall process of intellectualization of the economy. The influence of education and science, both directly and through other factors and driving forces of the development of society, is substantially increasing (AbuMezied, 2016). In such situae tion, the achievement of intellectual leadership begins to be perceived as a factor in ensuring competitiveness in the knowledge economy. There is an extension of the scope of his understanding – how to manage the change in the business environment (Blinder, 2008, p. 16). All these dynamic processes require thorough analysis and identification of common trends in the development of mechanisms for the achievement and assessment of intellectual leadership of multi-level entities in the global economy.

1. THEORETICAL AND EMPIRICAL BACKGROUND

1.1. Theoretical foundation

Scientific understanding of leadership issues is becoming an actual topic for many studies in various fields of science and practice. Modern understanding of leadership goes beyond the limits of psychology and management, greatly expanding. Leadership is perceived much wider than the psychological phenomenon, leadership becomes an element of the management process and increasingly becomes a plane of economic analysis at different levels of social organization.

The allocation of the concept "intellectual leadership" is due to the increasing importance of intellectual factors. In its understanding, there are different approaches in the scientific and analytical literature. Quite often, this term is used to refer to the process of personality management, the expansion of the boundaries of its intellectual activity. The second approach is a broader understanding, which is typical of the vast majority of scholars and international organizations. Under the intellectual leadership of countries, MNCs, organizations, companies, broadly speaking, is the expansion of the use of intellectual resources to achieve leadership and competitiveness. Some researchers are guided by the intellectual leadership of countries as the main subjects of international markets. So, intellectual leadership is understood as the use of intelligence as the main source of ideas and moral authority (MacGregor, 1978).

1.2. Literature review and hypotheses

Leadership issues are the issues of relevance to the research of a large number of scientists from different fields of science and practice. Thus, general issues of leadership were considered in the work of Senge et al. (2003), Ke de Vri (2003), Ouen et al. (2005) and others. Some aspects of intellectual leadership at the individual level are considered in the works of Gavrilina (2018). The study of the phenomenon of intellectual leadership in literature often reduces to the study of the impact of universities on economic and social development. In addition, for example, in the work of Macfarlane (2011), the role of the professor and his disposition in the structure of the university are studied, with the close-minded by Wepner, D'Onofrio, and Wilhite (2008) and Tozer (2017). The role of intellectual leadership in the formation of corporate value is studied in the work of Dealtry (2001). The formation of a new world order, which is subject to the processes of intellectualization, the study of its features, trends and characteristics, is found in the work of Lukyanenko et al. (2013).

However, the complexity and multidimensionality of the concept of leadership leave scientists a significant place for scientific research, since it still does not have a common understanding in approaches to the definition of intellectual leadership, needs an in-depth study of its form of manifestation, mechanisms for achieving leadership in modern conditions of intensifying competition in a complex interconnected and the globalized world. Of course, one of the most interesting in the scientific sense of the problem is the study of the forms of manifestation and assessment of such a phenomenon as the intellectual leadership of multi-level subjects at different levels.

The purpose of the work is to justify methodological approaches to the assessment of intellectual leadership and to analyze its manifestation at the level of intellectual resources. The object of research is the processes of competition and achievement of intellectual leadership of countries in the global environment.

2. DATA AND METHODOLOGY

The content of this study, scientific findings, conclusion and recommendations are based on the broad application of the systematic approach to the study of the phenomena. The proposed work demonstrates a thorough study of scientific works of domestic and foreign scientists devoted to the conditions of formation of global intellectual space. The following methods are used for achievement of the research goal: scientific literature review and modeling methods suggested quantitative empirical study to be performed in finding actual evidence for solutions of the defined scientific problem. Descriptive statistical analysis and visualization methods were applied to organize the research results. In the article, we used the methodology of comparative analysis and assessment of the dynamics of key indicators of innovation activity of the leading countries of the world.

3. RESULTS

Actualization of the problems of intellectual leadership is connected with the activation of the general process of intellectualization of the global economic space, an increase in the number of global flows of both the resources and the results of intellectualization. In the conditions of the formation of a post-industrial society, it is already an axiom that recognition of the fact that the breakthrough development of countries and individual organizations (corporations, universities, etc.) is ensured not so much by the availability of resources, but by the technologies they use, including those used to produce qualitatively new products and services. To become the world leaders and to hold the leadership positions is possible to those countries that make significant efforts in development of their intellectual potential and its implementation in the economy. At the core of the high values of the indicators and dynamics of the development of countries, such as Germany, Japan, South Korea, Singapore, Taiwan, Iceland, Finland, etc., are significant investments in research and development, the implementation of their results in products and services produced, as well as in qualitative changes in the spheres of life. In the modern world, the leader country is primarily an intellectual center, which is an integrator, initiator and organizer of actions.

The ambiguity of "leadership" concept, its manifestations in the modern economic environment necessitates the study of these issues on the basis of new conditions for its implementation.

In our opinion, intellectual leadership is the achievement of high positions in the competition due to the high quality and intensive implementation of intellectual resources. Intellectual leadership is viewed not as the ultimate goal, but as a key tool in achieving global leadership, which enables to enhance competitiveness and economic efficiency via intellectual resource accumulation. Subjects of intellectual leadership can be individuals, organizations, regions, countries. In turn, each of these subjects can demonstrate leadership among other actors of their level and at higher levels: organizational, regional, national, global.

In modern conditions, intellectual leadership is the achievement of high positions in competition through the high quality and intensive of the implementation of intellectual resources. Intellectual leadership is viewed not as the ultimate goal, but as a key tool in achieving global leadership, which enables the intellectual resource accumulation to enhance competitiveness and economic efficiency. Intellectual leadership is a complex process that can be described on the basis of system structuring by the main actors and levels of manifestation of the results of their intellectual activity.

Entities of intellectual leadership can be individuals, organizations, regions, countries. In turn, each of these subjects can demonstrate leadership among other actors of their level and at higher levels: organizational, regional, national, global. In addition, in our view, given the complexity of the phenomenon of intellectual leadership, it is

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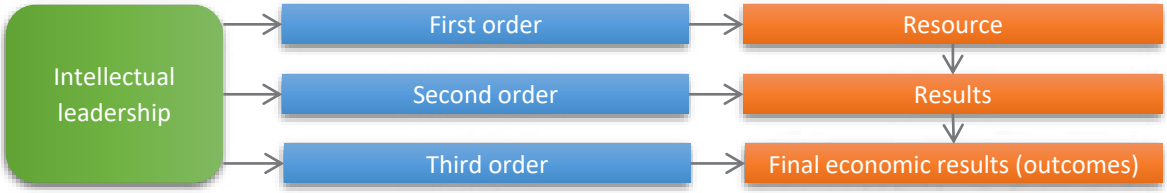

Figure 1. Levels of the implementation of intellectual leadership (compiled by the authors)

expedient to define levels of manifestation of intellectual leadership itself. It is rather difficult (if not possible) to generally assess intellectual leadership by one indicator. That is why we propose structuring the assessment of intellectual leadership at such levels of its manifestation: the level of resources, the level of results of intellectual activity, the level of final economic results. To evaluate the intellectual leadership of multilevel entities at each level is possible with a set of key indicators (Figure 1).

Leadership at each of these levels is evaluated using a range of indicators that characterize intellectual activity or the ability to build up intellectual potential. Thus, the leadership of the first level can be defined as resource one. At this level, the availability of intellectual resources determines the actor's ability to engage in intellectual activity and achieve intellectual leadership through the accumulation and increase of intellectual potential. The key development resources can be grouped into the following subgroups: financial, human and intellectual. In order to provide a more visible presentation, we present a set of indicators for the country level, while it can be applied to each individual entity (corporation, university, region, integration union of countries, etc.) (Figure 2). It should be noted that the list of indicators provided is not final, it can be expanded (subject to the need for more in-depth analysis), but the key set necessarily includes the specified parameters.

The availability of intellectual resources is a prerequisite for achieving intellectual leadership of the country, expanding its capabilities in a global-

Source: Compiled by the authors.

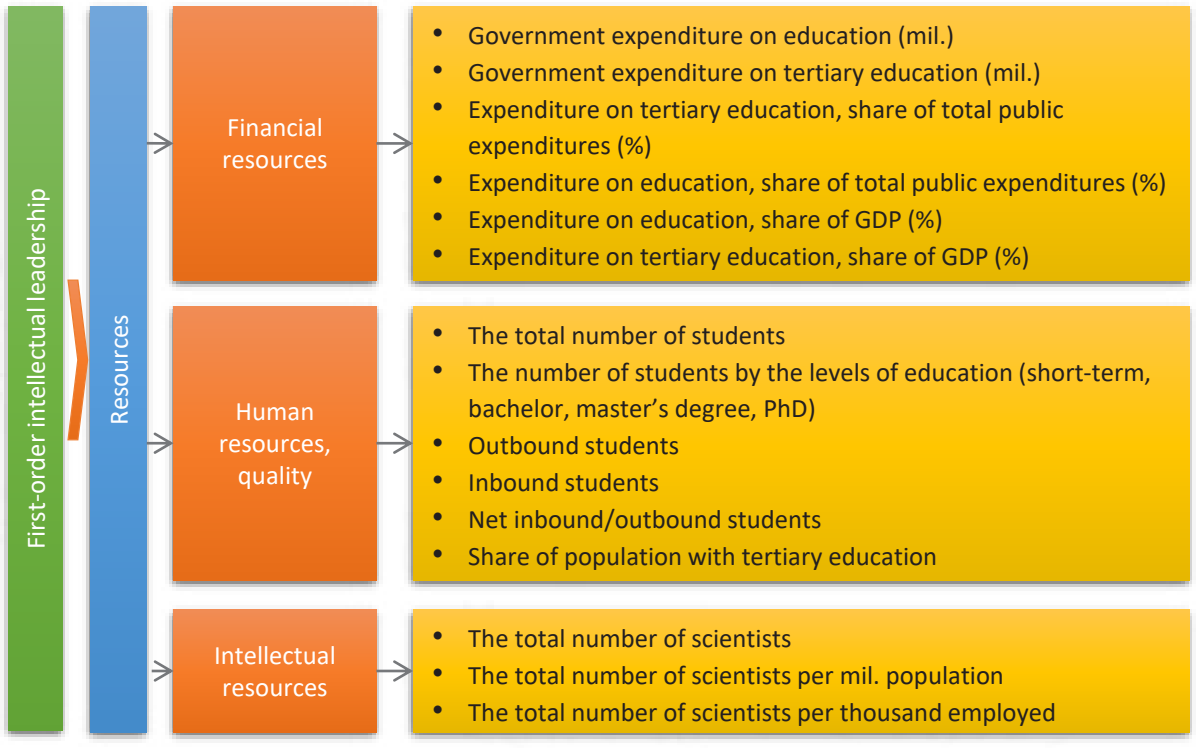

Figure 2. Key indicators of achievement of intellectual leadership first order

Table 1. TOP-10 countries by increase in number of students, 2005–2016

Source: Systematized by the author according to UNESCO enrolment in tertiary education, total number (http://data.uis.unesco.org/).

Country	Total numbers				%
	2005	2006	2015	2016	2016–2005 or the most relevant years
Turkey	2,106,351	2,342,898	6,062,886	–	287.84
India	11,777,296	12,852,684	32,107,419	32,391,800	275.04
Luxemburg	–	2,692	6,896	–	256.17
China	20,601,219	23,360,535	43,367,394	43,886,104	213.03
Hong Kong (China)	152,294	155,324	298,643	300,316	197.19
Colombia	1,223,594	1,314,972	2,293,550	2,394,434	195.69
Chili	663,694	661,142	1,221,774	1,236,701	186.37
Brazil	4,572,297	–	8,285,475	–	181.21
Mexico	2,384,858	2,446,726	3,515,404	4,244,401	177.97
Netherlands	564,983	579,622	842,601	836,946	148.14
Switzerland	199,696	204,999	294,450	295,149	147.80
World	139,648,065	147,371,357	214,083,295	215,945,197	154.64

ized world in a knowledge economy. The development of the intellectual potential (resources) of the country takes place through two main approaches: the formation of own resources and their attraction from external sources. Own potential is formed primarily by the system of education in general and higher education in particular. When analyzing the indicators of individual countries regarding the number of students, it should be noted that they tend to continuously grow (Table 1).

The majority of countries in the TOP-10 are developing countries, showing an increase at least at the level of the average global growth over a specified period. Absolute championship is held by Turkey, India and China, an increase in them of more than 200%. Of course, one of the reasons for such an increase in student contingent is the large population and the presence of significant potential for the expansion of higher education. It is noteworthy that the developed countries of the world do not demonstrate the high dynamics of the number of students because of the high level of education of the entire population.

Thus, among the leaders there are 4 countries, the number of students in them exceeds one million. There are also more than one million students in countries such as China, India, the USA, Brazil, Russian Federation, Turkey, Japan, Mexico, Korea, Germany, France, Great Britain, Colombia, Spain, Australia, Ukraine, Poland and Chile. These countries account for 68.65% of the total number of graduates.

In general, countries have rather significant differences not only in the number of students, but also in the total number of people with higher education. For instance, despite the high growth of number of students, in China, less than 10% of the population have higher education, which is one of the lowest rates among the countries under investigation. A similar situation can be noted for India, Colombia and Argentina. In general, according to the OECD, the proportion of people with higher education varies greatly (Figure 3).

As can be seen from the figure, the difference between the highest and the lowest level is more than 40%, i.e. 3.5 times. The group of countries with a high share of people with higher education includes countries with the highest GDP figures. In general, among the OECD and G-20 countries, the share of people with higher education is above 30%, while in countries that are world leaders by the level of GDP and development, this share is much higher.

In order to evaluate the intellectual leadership of the first level, students' performance at different levels of training (short-term courses, bachelors, masters, doctors of philosophy) is also impor-

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Source: Educational attainment and labor force status (https://stats.oecd.org/Index.aspx?DataSetCode=EDU_ENRL_MOBILE#).

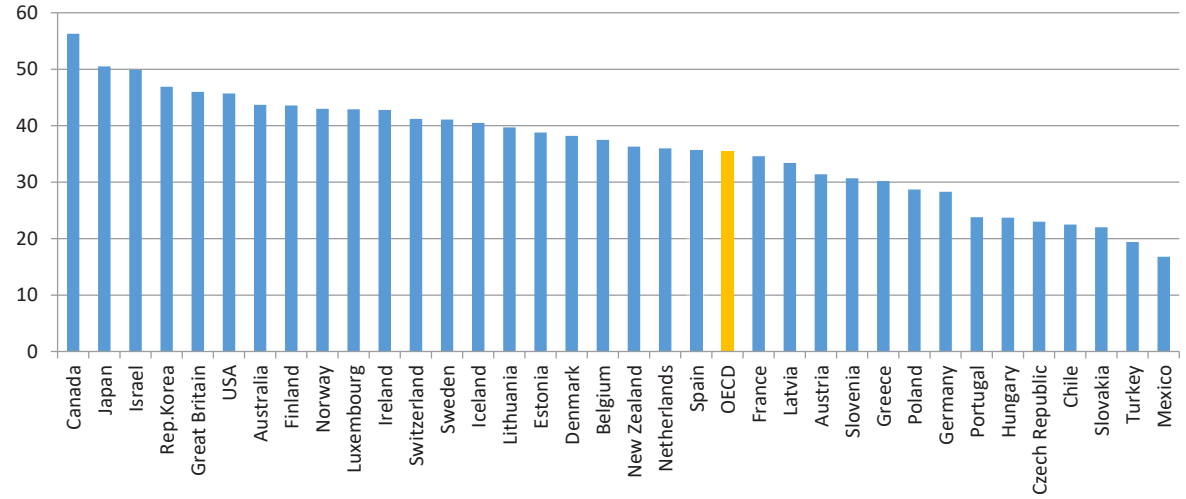

Figure 3. Share of people with higher education in OECD countries (2016), %

tant. This indicator reflects the country's potential for increasing the scientific potential of the its development. In general, the level of bachelor accounts for almost 70% of the total number of students in the world. At the same time, analysis by country shows a rather uneven distribution: while in the world, proportion of students in short-term courses is 20%, in the United States, this number exceeds the global level almost twice, and in Germany, it is only 0.01%. The highest rates are expected at the bachelor level, even in the country analysis. Master's degree level is the most widespread in France, Germany, Poland and Italy, where it is generally not much lower than a bachelor's degree. At that time, only about 10% of all students study at the master's level in Turkey, Mexico, Japan, the USA and China. The highest level of postgraduate education is demonstrated by Canada, Great Britain and Germany, exceeding the world level three times. At the same time, in Mexico and China, this proportion is less than 1%, which is 0.33% lower than the global figure.

In addition to developing their own intellectual potential, the mechanisms of attracting human potential from the environment are very actively used by countries. The most attractive for students are the educational systems of the United States, Great Britain, Australia, Russia, France, Canada, Germany and Japan, where the number of students from abroad exceeds the number of those who left the country by more than 100,000 people (Table 2). At the same time, volatility in attractive countries is much lower and demonstrates a steady tendency to increase of the balance. Australia, Canada, the USA, the Russian Federation and the Netherlands have the highest growth, with rates of 68%, 375%, 56% and 233%, respectively. It should be noted that the growth of the number of foreign students in Russia is due to the involvement of students from Asia, while European countries have a broader geography of students.

The next set of indicators includes financial resources allocated by the country for the formation of intellectual capital. Absolute and relative indicators of financing of education and science are important indicators in assessing the country's basic intellectual resources. They include government spending on education (higher education) and science in general, as a percentage of total public spending and relative to GDP. Such a structure makes it possible to analyze not only quantitative, but also qualitative parameters of financing and state's attention to systems of education and science.

Public spending on education as a share of GDP is a rather informative indicator reflecting the state's participation in the processes of formation of primary intellectual potential. In general, in developed countries, spending on education is in average 5.26% of GDP, but some countries show significantly higher rates (Table 3).

Table 2. Countries with the largest share of foreign students

Source: Systematized by the author according to UNESCO (http://uis.unesco.org/en/uis-student-flow).

Countries	2005	2008	2011	2012	2013	2014	2015	2016
Australia	167,407	220,671	251,603	238,415	237,895	253,757	282,374	323,181
Canada	25,646	47,801	74,837	89,403	104,764	117,022	121,990	139,063
France	187,154	197,133	207,879	207,387	152,418	153,543	153,168	–
Germany	–	–	–	–	77,048	93,077	112,856	–
Japan	61,352	75,398	115,243	116,843	102,373	98,988	101,489	–
Netherlands	16,145	21,746	24,832	42,564	55,402	55,961	71,036	74,382
Russia	50,763	91,760	113,695	122,490	–	157,537	169,099	186,865
Great Britain	295,089	319,922	392,501	401,048	388,127	398,749	399,254	–
USA	536,898	568,690	648,813	678,988	720,291	776,932	839,895	–

As the data in the table show, Denmark, Finland, Norway and Sweden spend more than 7% of GDP on education. Accordingly, these countries have the highest costs of higher education, exceeding the average rate of 1.28% almost two times. In general, it can be noted that if education costs are high enough in all countries, while in developed countries, the cost of higher education is exceeds the average, while in countries with lower levels of development, the cost of higher education is much below the average.

However, the costs of education and higher education in monetary terms are analyzed, the sit-

Table 3. Government expenditure on education and on tertiary education as a percentage of GDP (2005–2014), %

Source: Systematized by the author according to UNESCO and World Bank (http://data.uis.unesco.org; http://databank.worldbank.org/data/reports.aspx?source=Education%20Statistics).

Country	2005		2008		2011		2012		2013		2014	
	On education	On tertiary education	On education	On tertiary education	On education	On tertiary education	On education	On tertiary education	On education	On tertiary education	On education	On tertiary education
Denmark	8.09	2.32	7.48	2.12	8.48	2.37	7.24	2.17	8.49	2.28	7.63	2.34
Finland	6.04	1.92	5.85	1.81	6.48	2.08	7.19	2.05	7.16	2.01	7.15	2.00
Norway	6.87	2.22	6.28	2.01	6.45	1.93	7.36	–	7.47	1.99	7.68	2.19
Sweden	6.56	1.80	6.39	1.73	6.49	1.89	7.66	1.94	7.72	1.96	7.68	1.94
Belgium	5.77	1.25	6.29	1.34	6.38	1.40	–	–	6.64	1.45	6.60	1.45
New Zealand	6.28	1.45	5.51	1.59	6.94	1.90	7.15	1.81	6.70	1.69	6.36	1.59
Israel	5.76	0.95	5.54	0.89	5.56	0.90	5.67	0.92	5.84	0.93	5.74	0.88
Brazil	4.48	0.85	5.27	0.84	5.74	0.96	5.86	1.01	5.84	1.09	5.95	1.15
Austria	5.25	1.43	5.26	1.43	5.59	1.50	5.48	1.83	5.55	1.79	5.45	1.77
Australia	4.91	1.09	4.63	1.04	5.10	1.18	4.89	1.16	5.26	1.36	5.19	1.38
Estonia	4.84	0.92	5.52	1.10	5.02	1.26	4.71	1.03	4.84	1.37	5.48	1.44
France	5.50	1.16	5.44	1.21	5.52	1.26	5.46	1.24	5.51	1.24	5.52	1.25
Latvia	–	–	5.41	0.94	4.94	1.01	6.59	1.36	6.97	1.36	5.27	1.12
Slovenia	5.58	1.23	5.11	1.19	5.57	1.35	5.65	1.20	5.44	1.12	5.29	1.05
Switzerland	5.20	1.35	4.87	1.17	4.97	1.29	5.03	1.32	5.04	1.32	5.05	1.33
Great Britain	4.98	1.11	4.94	0.78	5.67	1.25	–	–	5.62	1.35	5.69	1.39
Portugal	5.07	0.92	4.70	0.91	5.12	1.01	4.95	–	5.28	0.90	5.12	0.91
Mexico	4.91	0.86	4.86	0.92	5.15	0.93	5.17	1.01	4.74	1.05	5.33	1.14
Netherlands	5.16	1.38	5.09	1.41	5.53	1.61	5.48	1.58	5.59	1.62	5.53	1.69
Ukraine	6.06	1.79	6.43	2.03	6.16	2.12	6.69	2.17	6.67	2.13	5.87	1.85
Canada	4.78	–	4.64	1.60	5.27	1.88	–	–	–	1.33	–	1.66

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Table 4. Expenditure on education (and tertiary) as a share of total public expenditures (2005–2015), %

Source: Systematized by the author according to UNESCO and World Bank (http://data.uis.unesco.org/; http://databank.worldbank.org/data/reports.aspx?source=Education%20Statistics).

Country	2005		2008		2011		2012		2013		2014		2015	
	On education	On tertiary education	On education	On tertiary education	On education	On tertiary education	On education	On tertiary education	On education	On tertiary education	On education	On tertiary education	On education	On tertiary education
Brazil	11.26	2.14	14.08	2.24	15.27	2.56	15.73	2.72	15.59	2.90	15.72	3.03	–	–
Chile	16.16	2.26	17.37	2.52	17.73	3.86	–	4.15	19.61	5.02	19.89	4.91	19.57	5.03
Colombia	15.54	2.15	14.68	3.24	15.53	3.20	15.51	3.41	16.91	3.00	15.85	3.29	15.11	3.23
Mexico	22.19	3.87	18.80	3.55	19.01	3.45	18.66	3.63	16.95	3.74	19.10	4.07	–	–
New Zealand	18.03	4.17	15.61	4.51	17.00	4.66	19.69	4.99	18.36	4.64	18.02	4.50	18.13	4.63
Norway	16.75	5.42	16.15	5.17	15.01	4.49	17.45	–	17.28	4.60	17.05	4.87	–	–
Sweden	12.68	3.49	12.94	3.50	13.09	3.81	15.12	3.82	15.02	3.82	15.20	3.84	–	–
Switzerland	15.82	4.11	16.01	3.84	15.55	4.04	15.64	4.12	15.21	3.98	15.46	4.08	–	–

uation changes significantly, which is due to the actual size of GDP in the designated countries. World leaders are undoubtedly the United States (USD 832.8 billion in 2014), Germany (USD 191.1 billion), Japan (USD 185.1 billion), France (USD 157.2 billion) Great Britain (USD 156 billion). (Government expenditure… 2017).

At the same time, the sum of TOP-15 countries by the level of education financing is USD 2,198,575.91 million and almost 40% of this amount falls on the US. The largest increase in education expenditure is demonstrated by Brazil – 365.8% over the period indicated, indicating an extremely active country's policy on education and the economy as a whole, given that, in % of GDP, this figure increased by only 1.5%. On average, the growth of education costs in a given group of countries is fairly stable and is at a level above 50%.

The country structure is almost unchanged in the analysis of countries with the highest costs of higher education. The top five leaders in 2014 are the United States (USD 229 billion), Germany (USD 51 billion), Japan (USD 38.4 billion), the United Kingdom (USD 38 billion), France (USD 35.5 billion).

The undisputed leader is the United States, although the percentage of GDP for higher education is even lower than the average for a given sample of countries. The total cost of TOP-15 countries for higher education is USD 580,327.9 million and again almost 39.5% of this sum falls solely on the USA, ahead of Germany 4.5 times. In general, the costs of higher education for the chosen period are characterized by higher volatility and lower rates of growth, even for countries with high growth rates at the general cost of education.

An important indicator characterizing the financial resources allocated by the country to the formation of intellectual potential and achievement of intellectual leadership of the first level is the share of education and higher education expenditure in the total public expenditure. On average, across countries, spending ranges from 8 to 20% on education in general and from 1.2 to more than 5% on higher education. Moreover, quite a small number of countries spend on education more than 15% of the total public expenditures (Table 4).

At the same time, Norway, Mexico, Turkey and the USA spend the most on the higher education. The fluctuations of these indicators are insignificant and during this period costs are held at one level, increasing in monetary terms.

In addition to the above, the indicator of financing of science in the countries is important. This is the highest level of intellectual capital formation in the country, and, accordingly, the most informational. The distribution of research spending in the world points to the obvious leading centers with the highest spending on science. The largest share of research and development costs is in South and East Asia with 37.6% of global spending. The second position in terms of costs is held by countries of North America with an index of almost 28% and third position includes European

Table 5. TOP-10 countries by expenditures on R&D, GDP (2005–2016), %

Country	2005	2008	2011	2012	2013	2014	2015	2016
Israel	4.05006	4.34759	4.0129	4.16119	4.15189	4.19966	4.26895	4.25121
Republic of Korea	2.62617	3.12343	3.74361	4.02554	4.14853	4.28874	4.21702	4.23871
Switzerland	–	2.71472	–	3.1873	–	–	3.3743	–
Japan	3.18099	3.33718	3.24477	3.20908	3.31496	3.4014	3.28644	3.1466
Sweden	3.387	3.49525	3.24919	3.28134	3.30605	3.14587	3.26549	3.2549
Austria	2.37324	2.56945	2.66868	2.91472	2.95492	3.06921	3.04771	3.08695
Denmark	2.39337	2.77346	2.94465	2.98125	2.97048	2.91404	2.95742	2.87125
Germany	2.42253	2.59712	2.79562	2.86813	2.82105	2.87289	2.91695	2.93949
Finland	3.32976	3.54708	3.63881	3.41948	3.28719	3.16931	2.89668	2.74846
USA	2.50599	2.76683	2.76965	2.68859	2.72486	2.73936	2.74043	2.74418
World	1.53139	1.60362	1.64124	1.65268	1.67409	1.6898	1.69514	..

countries with 21.6% of global spending. All other regions of the world spend on scientific research no more than 3% per region, or 12.8% of world expenses. In general, in 2015, USD 1,917.9 billion was spent on research. The most informative indicator is the level of expenditure on scientific and research work as a share of the gross domestic product (Table 5).

Israel has the highest level of R&D spending in the world with an indicator of 4.25%, South Korea is the second (4.23%). In general, more than 4% of GDP is spent on science only by these countries. The next block of countries, which also has an extremely high level of spending on science, are Japan, Switzerland, Sweden and Austria with indicators of over 3%. In general, all countries included in the TOP-10 have cost level that approximately 2 times higher than the global rate.

According to the logic of our study, the following group of indicators refers to the intellectual resources: the total number of scientists, their number per one million of population and the share of employees. These indicators characterize the intellectual component of human resources. The analysis of the structure of leading countries in terms of the total number of scientific personnel

Table 6. TOP-20 countries by total R&D personnel (in full-time equivalents and headcounts), 2005–2016

Source: Systematized by the author according to UNESCO (http://data.uis.unesco.org/).

Country	2005	2008	2011	2012	2013	2014	2015	2016
China	1,364,799.0	1,965,357.0	2,882,903.0	3,246,840.0	3,532,816.8	3,710,580.0	3,758,847.6	3,878,056.8
Japan	896,855.0	882,739.0	869,825.0	851,132.0	865,523.0	895,285.0	875,005.0	872,340.0
Russian Federation	919,716.0	869,772.0	839,183.0	828,401.0	826,733.0	829,190.0	833,654.0	802,317.0
Germany	475,278.0	523,504.7	575,099.5	591,260.8	588,615.0	605,252.0	640,516.0	656,727.0
India	391,149.0	–	–	–	–	–	528,219.0	–
Republic of Korea	215,345.2	294,439.6	361,374.2	395,990.0	401,443.7	430,868.0	442,027.1	447,408.2
France	349,681.3	382,652.8	402,491.7	411,780.0	416,687.3	423,902.7	428,642.9	–
Great Britain	324,916.5	342,085.5	356,258.3	356,484.4	377,342.9	396,280.8	413,860.0	419,898.0
Italy	175,247.6	221,115.0	228,094.0	240,179.2	246,764.0	249,467.0	259,167.0	258,585.0
Spain	174,772.9	215,676.4	215,078.8	208,831.4	203,302.0	200,232.6	200,866.0	205,873.0
Netherlands	93,599.0	93,432.0	117,435.5	122,215.1	123,214.4	124,065.9	129,060.0	133,214.0
Turkey	49,251.4	67,244.1	92,801.1	105,121.8	112,969.1	115,444.1	122,288.4	–
Poland	76,761.0	74,595.8	85,218.7	90,715.5	93,750.8	104,359.2	109,249.0	–
Sweden	77,557.0	79,549.0	78,445.0	81,272.0	80,957.0	83,473.0	83,551.0	90,690.0
Switzerland	–	62,065.7	–	75,475.8	–	–	81,451.0	–
Belgium	53,517.1	58,475.7	62,894.7	67,005.0	67,899.0	72,794.0	77,520.0	79,766.0
Austria	47,625.1	58,014.4	61,170.5	65,088.2	66,186.1	69,842.0	71,396.0	73,643.0
Ukraine	–	127,345.7	110,917.8	105,529.7	99,882.5	87,389.8	81,854.4	71,071.2
Czechia	43,370.4	50,807.9	55,696.9	60,329.4	61,975.9	64,443.5	66,433.4	65,783.0
Denmark	43,498.6	58,588.8	57,585.0	57,734.1	57,744.0	58,361.0	59,532.0	60,290.0

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and their number per one thousand of employees indicates significant differences in the list of leaders (Table 6).

For instance, the largest number of scientists in general falls on China, Japan, Russia, South Korea, Germany, India, France and the United Kingdom. At the same time, all countries show a steady tendency of the growth of total number of scientists. We can see Ukraine in this list as well, although it unfortunately shows a steady tendency of decline of the number of researchers. The presence of a contingent of scientists of 71,071.2 people in 2016 so far allows our country to be in the list of TOP-20, but soon enough we can lose it, provided that it does not overcome the pace of decline (by a total of 44% from 2008 to 2016). If we analyze the number of scientists per one thousand of employees, the structure of leaders significantly changes (Table 7).

As the table shows, the geographic structure of the leaders by the share of scientists per thousand employment has changed fundamentally. Thus, China, the Russian Federation, and India generally fell out of the list of leading countries, in which only the highly developed countries of Europe and Asia remained, showing stable rates of economic growth and innovative development. This indicator in the first place indicates the qualitative parameters of the labor market and the intellectual component of all employed persons. In Ukraine, over the past 10 years, it has lost its place in a cohort of countries with a significant number of scientific personnel per 1,000 employment, reducing the indicator from 7 to 4 in 2016, which is much lower than in Turkey or China.

We can conclude that intellectual leadership is a complex phenomenon, which can only be assessed with the help of a complex of indicators. The above data confirms that countries can be leaders in some absolute indicators, may lose leadership positions by relative indicators. But if it is such powerful economies as the US and China, their leadership is undeniably confirmed by further in-depth analysis based on other indicators (second and third order). Also, further analysis can confirm some problems and lagging behind countries that have separate good positions on individual indicators.

As noted at the beginning of the article, resource potential assessment is an important and necessary step in the overall analysis of intellectual

Table 7. TOP-20 countries: total R&D personnel per thousand total employment (in full-time equivalents), 2005–2016

Source: Systematized by the author according to UNESCO (http://data.uis.unesco.org/).

Country	2005	2008	2011	2012	2013	2014	2015	2016
Denmark	15.7	20.5	21.2	21.4	21.3	21.4	21.6	21.3
Luxembourg	22.5	22.4	22.3	19.6	20.0	20.3	19.9	19.9
Finland	23.8	22.2	21.9	21.7	21.5	21.2	20.6	19.3
Sweden	17.7	17.3	17.0	17.5	17.2	17.6	17.5	18.8
Switzerland	–	14.6	–	17.1	–	–	17.7	–
Ireland	8.3	9.4	11.3	12.2	12.4	14.4	17.5	17.5
Austria	12.5	14.3	14.8	15.5	15.7	16.6	16.9	17.3
Belgium	12.6	13.1	13.9	14.8	15.0	15.9	16.9	17.2
Republic of Korea	9.1	12.1	14.6	15.8	15.8	16.6	16.9	16.9
Norway	12.9	14.0	14.6	14.6	14.8	15.3	16.0	16.6
France	13.6	14.4	15.2	15.6	15.8	16.2	16.3	–
Iceland	19.0	17.3	18.3	–	14.8	–	15.1	16.2
Germany	13.1	13.7	14.5	14.8	14.6	14.9	15.7	15.9
Netherlands	11.4	10.7	13.9	14.5	14.8	14.9	15.3	15.7
Slovenia	9.5	11.7	16.3	16.1	16.7	16.1	15.4	15.6
Japan	14.0	13.6	13.7	13.5	13.6	13.9	13.5	13.4
Czechia	9.0	10.2	11.3	12.2	12.4	12.8	13.0	12.7
Italy	7.7	9.5	10.1	10.7	11.3	11.5	11.9	11.7
Portugal	5.0	9.2	10.4	10.4	10.5	10.3	10.5	10.9
Greece	7.2	–	8.6	9.5	11.3	11.5	13.0	10.7

leadership. The set of indicators can be significantly expanded, as well as modified for other entities (corporations, universities, regions, etc.). In general, it is a basic set that characterizes the initial conditions for intellectual activity and intellectual leadership of multilevel entities. These indicators are key to understanding the country's capabilities, expanding its competitiveness, and increasing the prerequisites for achieving intellectual leadership on a global scale.

However, the availability of resources is not always a decisive factor in achieving leadership at the global level. That is why we further consider more in-depth studies of factors of indicators and mechanisms for achieving intellectual leadership.

DISCUSSION AND CONCLUSION

Actualization of the problem of leadership in the modern global environment is connected both with the aggravation of competition and the complication of the structure of the global economy and the factors of its development. The separation of intellectual leadership is due, on the one hand, to increasing the role of intellectual resources in achieving leadership positions in a variety of criteria for economic and innovative development, and, on the other hand, it becomes an independent sphere of global competition.

The methodological approaches proposed in the article to the assessment of intellectual leadership are a multi-stage system of analysis of multi-level indicators of intellectual activity at the levels of resources, results and outcomes. The scale of the analysis made it possible to present in this article only the results of the conducted research at the first level – an analysis of the resource component of intellectual leadership. It is equally important and interesting to study the following levels, as well as to find correlation between source resources and the end results of multilevel entities in the global economy. Undoubtedly, the scientific interest is represented by the implementation of the presented methodology to assess the intellectual leadership of other actors, such as corporations and regions.

We consider that analyzing and evaluating the intellectual leadership of different actors is important not only in order to ascertain the disposition of different actors, but first and foremost – to identify key trends in the development of the global economy, the key aspects that are important for their breakthrough development and competitiveness in the global space. Thus, the problem of the manifestation of intellectual leadership still leaves a great deal of space for further research both in terms of identifying quantitative dependencies and the role of intellectual factors, and in the context of in-depth analysis of factors and leadership mechanisms through the accumulation and active use of intellectual resources.

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