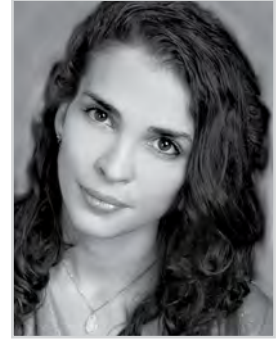**Yulia Polozhentseva**
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KPI-monitoring for university's performance improvement

Abstract. Approaches based on KPI-monitoring are used by commercial entities worldwide. However, such an approach is new and insufficiently developed for universities. Specific features of their functioning necessitate not just assessment of their economic efficiency but also consideration of special aspects of higher education. Therefore, studying the issues of university performance monitoring based on the development of a system of indicators is challenging in terms of encouraging rapid international development of «smart economy». The article contains analysis of universities' global rankings based on the selection of indicators of KPI-monitoring system to show development of university competitive strengths related to countries' economic development.
Keywords: KPI-monitoring; Efficiency; University Potential; University Performance; Indicators; KPI of Universities; Global University Ranking; Educational System; Japan; USA; Canada; Great Britain
JEL Classification: I21; I25; F43

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KPI-моніторинг для підвищення ефективності діяльності університетів
Анотація. У світовій практиці використано підходи, які базуються на використанні KPI-моніторингу в комерційних організаціях, що дозволяють виокремити пріоритетні цілі розвитку та ступінь конкурентоспроможності суб'єктів. Однак для аналізу економічної діяльності вищих освітніх закладів такий підхід залишається новим і недостатньо розробленим. Моніторинг ефективності університетів на основі KPI-індикаторів є актуальним з огляду на стимулювання випереджувального розвитку «розумної» економіки. У статті проаналізовано світові глобальні рейтинги університетів на основі селекції показників KPI-моніторингу, що характеризують ступінь розвитку конкурентоспроможних переваг ВНЗ, необхідних для стимулювання інтенсивного економічного розвитку країн. Проведено KPI-моніторинг університетів на основі виділення базових критеріїв їх діяльності залежно від цільової орієнтації. Запропоновано заходи для підтримки різних університетів залежно від визначеного KPI-показника шляхом обґрунтування програми розвитку наукового й освітнього потенціалу.
Ключові слова: KPI-моніторинг; ефективність; потенціал університетів; система показників; KPI університетів.

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KPI-мониторинг для повышения эффективности деятельности университетов[1]
Аннотация. В мировой практике используются подходы, основанные на использовании KPI-мониторинга в коммерческих организациях, позволяющие выделить приоритетные цели развития и степень конкурентоспособности субъектов хозяйствования. Однако для образовательной среды данный подход является новым и недостаточно разработанным, поскольку специфика деятельности университетов предполагает не только на оценку их экономической эффективности, но и результаты учебной работы. Поэтому изучение вопросов мониторинга эффективности деятельности университетов на основе построения системы индикаторов актуальны с точки зрения стимулирования опережающего развития «умной» экономики. В статье проведен анализ мировых глобальных рейтингов университетов на основе селекции показателей KPI-мониторинга, характеризующих конкурентные преимущества высших образовательных заведений, необходимые для стимулирования интенсивного экономического развития стран. Проведен KPI-мониторинг университетов на основе выделения основных критериев их деятельности в зависимости от целевой ориентации потенциала. Предложены меры поддержки различных университетов в зависимости от выделенного KPI-показателя на основе обоснования программ развития научного и образовательного потенциала.
Ключевые слова: KPI-мониторинг; эффективность; потенциал университетов; система показателей; KPI университетов.

1. Introduction

The current stage of development of the knowledge society and knowledge-based economy has predetermined the mainstreaming of KPI-based university efficiency evaluation of intellectual resources. Under the conditions of the growth of international educational mobility, aimed to improve competitive abilities of universities, KPI-monitoring is essential to distinguish resulting indicators of their long-term development. Therefore, defining key factors of universities' potential unlock on the basis of knowledge content and intellect intensity will make it possible to distribute government and private investments efficiently. However, the mechanism of KPI-based investment distribution to universities is still an important challenge in many countries. Hence, studying of basic universities' performance criteria, including goal orientation of their potential on the basis of KPI monitoring, constitutes a practical research interest.

2. Statement of the Research Problem

Amid economy transition to the sixth wave of innovation (or sixth technological mode), boost in development of education as an infrastructural element of the market-driven economy is required. Therefore, economic performance is impossible without integration of education into the world economic space in order to activate existing competitive strengths and stimulate potential points which will provide shift to a new level in public sector and economy. In course of development of a country's scientific and educational potential, universities should encourage intensive economic development. Universities' KPI-monitoring based on the comparative analysis of tools and approaches to their activities is essential. Grounding and alignment of universities' performance criteria will allow creating an integrated space for further consolidation of social and humanitarian potential of society.

3. Brief Literature Review

Change of the efficiency of business communities is considered to be one of the key elements of strategic management which can determine the gap between the current state of institution and its potential level to be reached in course of development. The majority of the researchers focus their attention on the assessment of businesses, and do not pay much attention to the research of key performance indicators for universities, many of which are public institution with strong social orientation of activities.

To study business processes' effectiveness of universities, it is necessary to use key performance indicators. Several concepts that reflect specific features of institutional performance, introduced into the system of strategic management, have been developed in the world practice. They are Balanced Scorecard System (Norton & Kaplan, 1996) [1], ABPA - Activity-Based Performance Analysis by Meyer (2003), Brown concept (2007), and Hill & Jones (2012) KPI system.

Production is still essential for country's development. However, globalization has changed the philosophy of institution's competitive ability evaluation with inclusion of performance indicators based on the knowledge economy, shown in research by Friedman (2005). Some scholars propose indicators for knowledge management evaluation, for example, Olve (1999) introduces intellectual capital index and university strategic map based on key indicators.

Liebowitz (2013), Poyhonen & Hamalainen (2001), Roper & Dundas (2015), Mills & Smith (2011) realised researches in the area of knowledge management; they noted that the main problem is the measurement of the results of educational institutions in the sphere of knowledge management.

In spite of the significant amount of scientific research devoted to the analysis of KPI-monitoring systems for business groups and knowledge evaluation, there are some controversial issues on KPI-monitoring applying for the evaluation of universities' performance.

4. The Purpose of the Article is to develop theoretical and practical approaches to the research of universities' performance indicators on the basis of the comparative analysis of global rankings, to estimate resulting indicators of their activities' assessment based on KPI-monitoring.

5. The Key Findings of the Study

At the present time, effective national economy depends on the use of all available resources, including intellectual ones. Therefore, its international assessment is becoming increasingly important, in particular, assessment of university performance by means of KPI-monitoring.

In 2014, according to The Learning Curve Index by Pearson PLC and The Economist, the most effective educational systems in the world were defined [11]. We conducted a comparative analysis of educational systems on the basis of comparison of selected international indicators and rankings that reflect the level of education development, particularly higher education development (see Table 1).

Our research contains the analysis of global rankings of universities based on the selection of KPI-monitoring system indicators which characterize the degree of the development of their competitive strengths necessary to stimulate the intensive economic development of the countries.

Tab. 1: **Comparative analysis of the best educational systems of the world**

Country's position in the ranking of the best educational systems in the world	Countries	Educational attainment, %	Students' skills (average performance by students, according to Program for International Student Assessment), score	Years in education	Government expenditure on education, (total % of GDP)	EDI, Education for All Development Index	Education Index	Number of times when the country has taken leading positions (positions 1-3)	Number of times the country has been at the bottom of the list (positions 15-20)
1	2	3	4	5	6	7	8	9	10
1	South Korea	85	542	17.5	4	0.975	0.865	2	1
2	Japan	94.3	540	16	3.8	0.994	0.81	4	3
5	Finland	86.5	529	19.7	7.2	0.992	0.817	4	1
6	The UK	79.2	503	16.7	5.7	0.994	0.885	1	0
7	Canada	90	522	16.3	5.4		0.874	0	0
8	The Netherlands	75.9	519	17.9	5.6	0.987	0.894	0	1
9	Ireland	78.8	516	17.8	5.8	0.985	0.907	0	0
10	Poland	90.5	521	17.9	4.8	0.984	0.824	0	0
11	Denmark	79.6	498	19.6	8.6	0.989	0.924	1	0
12	Germany	86.9	515	18.1	4.9	0.985	0.893	0	0
13	Russia	94.7	481	16.1	4.2	0.981	0.806	1	3
14	The USA	89.6	492	17.1	5.2	0.975	0.889	0	1
15	Australia	77.1	513	19.2	5.3	0.984	0.932	2	2
16	New Zealand	74.1	509	18	6.4	0.986	0.917	1	2
17	Israel	85.4	474	15.9	5.9	0.973	0.861	0	3
18	Belgium	73.6	509	18.8	6.6	0.967	0.829	1	2
19	The Czech Republic	93.2	500	17.4	4.3		0.866	1	2
20	Switzerland	88	518	17.4	5.1	0.992	0.866	1	1

Notes: Positions 3 and 4 occupied by Hong-Kong and Singapore respectively were excluded from the analysis due to the lack of sufficient amount of statistical data, thus making further analysis irrelevant.
3 - reflects the level of higher education in the country;
7 - EDI includes assessment of 4 components (primary for all education, adult population literacy rate, sex, quality of education);
8 - Educational level index: 1. Adult population literacy rate, (2/3 of weight). 2. Index of the aggregate share of students in primary, secondary and higher education (1/3 of weight).

Source: Compiled by the authors based at [11]

Almost all of the analyzed educational systems are among the leaders according to certain indicators, but it is difficult to identify the most effective system. However, it can be concluded that such countries as Japan, the USA, Canada and the UK have the leading educational systems in the field of higher education. Thus, the further research of the assessment of university rankings was based at the results for these countries as well as Russia (Table 2).

Tab. 2: **Analysis of the global universities rankings based on KPI-monitoring system indicators selection**

Ranking	KP-indicator	University	Year				
			2012	2013	2014	2015	2016
Innovation							
CWTS Leiden Ranking	1. Citation Impact 2. Scientific Collaboration	University of Oxford	13,919	12,208 24,707	12,100 25,244	12,935 27,817	13,300 29,508
		Stanford University	15,032	12,841 24,490	13,399 25,777	14,102 27,593	14,615 29,432
		University of Cambridge	14,046	11,742 22,622	11,778 23,479	12,170 25,069	12,506 26,554
		Harvard University	33,511	29,812 56,995	29,693 56,018	31,137 60,293	32,253 63,936
		University of Toronto	20,966	18,114 31,930	19,083 31,971	19,948 34,594	21,544 37,991
		University of Tokyo	18,382	14,175 28,559	14,339 29,341	14,535 30,265	14,429 30,473
		Lomonosov Moscow State University	8,719	2,518 5,773	2,888 6,865	3,178 7,717	3,362 8,450
Academic and commercial							
THE WUR Times Higher Education Worldwide Universities Ranking	1. Teaching 2. International Diversity 3. Industry Income 4. Research 5. Citations	University of Oxford	93.6	93.7	93.9	93.2	94.2
		Stanford University	93.9	93.7	93.8	92.9	93.9
		University of Cambridge	92.4	92.6	92.3	92	92.8
		Harvard University	93.9	93.6	93.9	93.3	91.6
		University of Toronto	81.6	82.2	78.,3	79.3	83.9
		University of Tokyo	74.3	78.3	76.4	76.1	71.1
		Lomonosov Moscow State University	284/ position in the ranking	207/ position in the ranking	230/ position in the ranking	46	51.9
Academic							
QS World University Rankings	1. Academic Reputation (40%) 2. Employer Reputation (10%) 3. Faculty / Student ratio (20%) 4. International Student ratio (5%) 5. International staff ratio (5%) 6. Citations per Faculty (Scopus) (20%)	University of Oxford	98.57	98.7	99.2	97.7	96.8
		Stanford University	91.68	96.8	98.3	98.6	98.7
		University of Cambridge	99.78	99	99.4	98.6	97.2
		Harvard University	99.15	99.2	99.3	98.7	98.3
		University of Toronto	89.64	91.3	92.4	87.1	83.8
		University of Tokyo	84.95	85.7	86.7	79.4	82.6
		Lomonosov Moscow State University	61.79	63.9	66.9	67.2	77.1
Academic							
Academic Ranking of World Universities (ARWU)	1) Alumni as Nobel laureates and Fields medalists (10%) 2) Award - Staff as Nobel laureates and Fields medalists (20%) 3) HiCi - highly cited researchers according to Essential Science Indicators (ESI) from Thomson Reuters 4) N&S - Papers published in «Nature» and «Science» (20%) 5) PUB - the number of citation acc. to Web of Science Core Collection. Only for «Science Citation Index-Expanded» and «Social Sciences Citation Index» (20%) 6) PCP - total of the 5 mentioned above indicators divided by FTE (Full time equivalent) (10%)	University of Oxford	56.1	55.9	57.4	56.6	58.9
		Stanford University	72.8	72.6	72.1	73.3	74.7
		University of Cambridge	69.8	69.6	69.2	58.8	69.6
		Harvard University	100	100	100	100	100
		University of Toronto	40.8	40.3	41.8	40.6	39.4
		University of Tokyo	43.8	43	43.2	42	42.2
		Lomonosov Moscow State University	26.3	26.1	26.1	25.3	26.2
Innovation and commercial							
Round University Ranking	1. Teaching 2. Research 3. International Diversity 4. Financial Sustainability	University of Oxford	91.119	93.049	93.557	95.111	93.218
		Stanford University	96.610	96.573	98.213	98.099	97.504
		University of Cambridge	91.518	94.087	94.942	94.993	93.448
		Harvard University	98.5	98.674	100	100	98.67
		University of Toronto	83.004	84.034	84.843	84.773	82.399
		University of Tokyo	85.67	82.368	83.281	84.361	83.769
		Lomonosov Moscow State University	64.35	63.891	67.551	71.376	69.783
Academic							
SCImago Institutions Rankings: (SIR)	1. O. Output number of papers published indexed in Scopus 2. % IC. International Collaboration - Output produced in collaboration with foreign institutions 3. NI. Normalized Impact shows institution's citation in comparison with average world value, e.g. value 0,8 means the institution's cited 20% below world average 4. % Q1. High Quality Publications ranked in the first quartile (25%) in relevant categories 5. Scientific talent pool determines the coverage of the subjects in the institution. Values vary from 0 to 1. Value 1 = the institution covers all the areas included in Scopus 6. % Exc. Excellence Rate indicates the amount of institution papers in top 10% of the most cited papers in their respective fields 7. % Lead. Scientific Leadership indicates the amount of institution's output as the main contributor 8. % EwL. Excellence with Leadership - the amount of documents in Excellence where the institution is the main contributor	University of Oxford	26	23	17	16	14
		Stanford University	5	6	7	8	7
		University of Cambridge	23	24	22	25	19
		Harvard University	2	2	2	3	3
		University of Toronto	15	13	14	17	17
		University of Tokyo	17	16	18	22	18
		Lomonosov Moscow State University	453	404	379	383	357

Source: Compiled by the authors based at university rankings

Intention to accelerate the growth of knowledge economy based on the analysis of fundamental criteria of activity of educational institutions demonstrates the need for cross-country comparisons of universities on key performance indicators. For the implementation of the KPI-monitoring of universities we assessed key criteria of their activities according to the focus of their potential, using diverse KPI systems based on the study of various aspects of university activities: research, innovation, and commercial ones.

Based on the analysis of the international rankings of the universities' performance, it can be concluded that the scope of universities which usually occupy leading positions is almost permanent; such world-renowned universities include Stanford, Harvard, Cambridge, and Oxford. Among Russian universities only Lomonosov Moscow State University usually occurs in the rankings, and its positions are below average.

On the basis of the comparative analysis, some supportive measures for different universities depending on the dominant KP-indicator have been identified:

1. In the field of university management and development of scientific potential following improvements are required:
- quality management system in accordance with the educational standards for educational process and scientific research on the basis of international standards ISO 9000, and Standards and Guidelines of the European Association for Quality Assurance in Higher Education ENQA;
- methods of planning, budgeting of financial activities and controlling system to ensure the development of mechanisms of multi-channel financing of universities for better scientific and infrastructure development;
- employee incentive systems, aimed at the achievement of the planned performance indicators, including regular practices and tools of monitoring and control of key indicators of human resources development;
- conditions for students' personal success in their professional spheres.

2. In the field of university innovative educational environment the following improvements are required:
- interdisciplinary innovative programs of priority areas of science, technology and engineering development in order to harmonize with the need for territorial human resources;
- public-private partnerships for cooperation between business and universities;
- areas of the development and implementation of new technologies and forms of education, training and organization of educational process;
- CALS-technologies of innovative management of universities' educational activities;
- effective mechanisms for university branding;

3. In the field of generation and commercialization of knowledge, competitive technologies and innovations the following improvements are required:
- research projects, including qualitative increase in the level of basic research within priority areas in science, technology and engineering, such as space, biosphere, nanotechnologies, IT-technologies, energy saving, chemistry, etc.;
- system of monitoring of social and economic development, and consulting for technological modernization of the national economy and improvement of its competitiveness through advanced technologies;
- development of students and academic staff mobility and integration into the international scientific and educational space. To do this, it is necessary to increase the academic mobility of students, educators, and researchers; improve progress of international relations of universities in education and science; organize joint activities in science and technology, and joint scientific research increasing the number of international agreements.

KPI-monitoring is aimed at solving a range of strategic tasks that universities face, focused on the making effective management decisions in the area of financial policy, personnel, innovation and scientific potential, educational process.

The proposed measures implementation will improve the competitiveness of universities in the global educational market; ensure the quality of training in accordance with the requirements of international standards and global market of education and labour; implement priority trends of training and educational programs.

6. Conclusion

The paper includes the results of the comparative analysis of the structure of universities' KPI-monitoring systems depending on the level of their potential development. The current development of higher education requires new approaches to the development of human and scientific-innovative resources, considering a lot of internal and external indicators: improvement of university innovative investment activities, development of cooperation of business and universities, improvement of regional and national competitiveness in the educational market, strengthening of globalization processes, etc. The generated supportive measures for universities are aimed to support their effective performance and to fulfil the objectives aimed at the improvement of universities' competitive strengths.

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