

# Key Performance Indicators (KPI) System in Education

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## Abstract

This article conducts the analysis of key performance indicators (KPI) applied in Russian educational system today. Analysis of foreign researchers' scientific approaches to the practice of application of such performance indicators as citation index and number of publications in magazines was conducted from the point of view of the accuracy of performance evaluation of scientific and teaching staff. Evaluation of indicators significance is made. Comparative analysis of basic performance indicators that Russian leading universities are going to reach in 2020 in their programs of competitive growth among world leading scientific and educational centers is given.

**Keywords:** key performance indicator, educational system, citation index, number of publications

## 1. Introduction

One of the latest tendencies of education system in Russia and system of higher education in particular is a dynamic transition to management system based on key performance indicators (KPI). KPI give opportunity to evaluate the performance of actions of individual employees and also of particular divisions (departments, research laboratories, scientific centers, faculties, branches) and of educational institution as a whole. However in order to apply KPI it is necessary to take into account many factors and also to consider 50-year experience of foreign education system of applying different performance indicators for evaluation of results of scientific and educational institutes as a whole and results of individual researchers and teachers.

## 2. Theoretic Background

Necessity and efficiency of key performance indicators in foreign educational institutions is being under discussion for a long period of time. For example, an article about usefulness of citation index in science by E. Garfield published in Science magazine in 1955 (Garfield, 1955), and his further researches of this issue (Garfield, 1979) were widely spread.

Foreign science has also studied in details questions of application of different performance indicators to evaluation of efficiency of school education (Adnett & Davies, 1999; Broadbent et al., 1999; Visscher, 2001), and also to evaluation of work results of library and information center employees (Oppenheim, 1995). In particular article by Anderson with an impressive title "No citation analyses please, we're British" published by Science magazine has caused a wide response and vigorous discussion in foreign scientific literature (Anderson, 1991). Practical application of key performance indicator in British system of education and scientific researches in general and also skeptic attitude of many British researchers to the necessity to evaluate the results of their scientific activity by citation indexes only could be found in many works of that time and of the present (Narin, 1976).

Researches by B. Cronin and his colleagues of 90s years of XXth century prove that the number of citations of scientists works is one of the primary factors of academic reward system in foreign scientific, research, educational, informational institutions of all levels (Cronin, 1996; Cronin et al., 1997). However citation indexes represented in the most famous citation systems Web of science and Scopus do not include a considerable part of citations from monographic literature. Having analyzed thousands of references from monographs and leading scientific magazines B. Cronin and his colleagues found out that relative ranking of authors who had high citation indexes in monographic literature were often not very high or were not represented at all in magazines of the same period. B. Cronin found only very little overlapping between the most cited references in magazines and references to monographs. Authors drew a conclusion that citation in scientific magazines and citation in monographic and educational literature do not correlate; they also put forward a hypothesis that two types of

authors' citation are possible. Quantitative indexes of activity and in particular number of publications and number of references to them are closely connected to bonuses of scientists and their career mobility (in some cases they are the main factor of performance evaluation of scientific and teaching employees), but they do not give understanding of their real qualification; that is why in order to evaluate the activity of employees of education system it is necessary to find a special approach to application of citation indexes and other quantitative factors connected to scientific publications. B. Cronin and his colleagues offered their own method of using indexes of citation of scientific publications as a means and indicator of evaluation of real quality of scientific researches.

British scholars continued these researches in respect to other fields of science (Lee, 2011).

The second widely debated question in this sphere is the process of forming leading higher educational institutions based on application of KPI. Results of many latest researches are devoted to the analysis of these questions (Breakwell & Tytherleigh, 2008; Breakwell & Tytherleigh, 2010; Goodall, 2006).

General urgency of analysis of the results is caused by the fact that at the present time Russian higher educational institutions are forming rating system of evaluation of their activity on the system of performance indicators, where quantitative indexes of authors' citation, of number of their articles in particular magazines, etc. are stated as key ones though foreign scientists argue and object to it for a long period of time already.

### 3. Research Methodology

We apply comparative analysis method to study the usability of different performance indicators of Russian educational institutions work.

For informational and statistic basis of the research let's take development programs ("communication maps") of the leading Russian Educational Institutions and first of all of those institutions that receive government support for implementation of campaign aimed at competitive growth in the world as a part of competitive growth program of the leading universities of the Russian Federation among the leading world scientific and educational centers (the so-called "5-100" program that is supposed to ensure that five Russian Universities should enter TOP-100 of the best world universities according to one of the three world rankings - THE, QS and ARWU).

### 4. Research

In spring of 2013, 54 Russian Universities applied to the contest to receive government support for competitive growth among the leading world scientific and educational center according to the Regulation of the Government of the Russian Federation dated 16 March, 2013 No. 211 "About measures of government support of the leading Universities of the Russian Federation aimed at their competitive growth among the leading world scientific and educational centers" (Regulation, 2013).

Moscow State University and Saint Petersburg State University did not participate in the contest because they already have development programs supported earlier. In 2012 Moscow state University took 80<sup>th</sup> position in ARWU (Academic Ranking of World Universities) and 116<sup>th</sup> position in QS World University Rankings. However speaking about THE (Times Higher Education World University Rankings), MSU has a position below the third hundred. Saint Petersburg State Universities is in the fifth hundreds of ARWU, has 253<sup>d</sup> position in QS rankings and in 388<sup>th</sup> position in THE rankings.

36 Universities qualified to the second tour of the contest and represented their development programs to International Selection Committee in October, 2013. According to the results of live presentations of the development programs 15 Universities had won and 12 of them received government support (For Universities, 2013). Moreover programs of three Universities were singled out as the most effective ones: these are programs of National Research Institute Moscow Institute of Physics and Technology (State University), of National Research Nuclear University MEPhI and of National Research University Higher School of Economy.

One of the selection criteria was the introduction of the sound system of development performance indicators and their significant improvement. For the comparison of basic indicators of the leading Russian universities that received government support see Table 1. This table is based on Plans of actions and on Programs of competitive growth of the corresponding universities. References to the bodies of the corresponding documents are given in the References section.

In lines of Table 1 there are abbreviations of the following analyzed universities:

KFU - Kazan (Volga region) Federal University;

MIPT - National Research Institute Moscow Institute of Physics and Technology (State University);

MEPhI - National Research Nuclear University MEPhI;  
 NRU HSE - National Research University Higher School of Economy;  
 NUST MISIS - National University of Science and Technology MISIS;  
 NRU LSUNN - National Research University Lobachevsky State University of Nizhni Novgorod;  
 NSU - Novosibirsk State University;  
 SPSPU - Saint-Petersburg State Polytechnical University;  
 NRU ITMO - Saint-Petersburg National Research University of Information Technologies, Mechanics and Optics;  
 NRU TSU - National Research Tomsk State University;  
 NRU TPU - National Research Tomsk Polytechnic University;  
 UrFU - Ural Federal University named after the first President of Russia B.N. Yeltsin.

In columns there are the following identifiers of key indicators:

PKI<sub>1</sub> - Position (accurately to 50) in leading world rankings - in QS list, position (Position in QS Ranking);

PKI<sub>2</sub> - Number of publications in Web of Science and Scopus excluding doubling of 1 SPE, number (Publications per faculty member);

PKI<sub>3</sub> - Average citation index of 1 SPE, calculated according to sum-total of publications included in data bases of Web of Science and Scopus, excluding doubling, number (Citation per faculty member);

PKI<sub>4</sub> - Percent of foreign professors, teachers and researchers among SPE including Russian citizens who have PhD degree of foreign universities, % (Foreign faculty);

PKI<sub>5</sub> - Percent of foreign students studying basic educational programs of the university including students from CIS countries, % (Foreign Students);

PKI<sub>6</sub> - Average USE score of university students who entered full-time course of study at the expense of federal budget on bachelor degree program and on specialist training program, score (Average USE score);

PKI<sub>7</sub> - Percent of revenue from non-budget sources in university revenue structure, % (External Revenue).

Table 1. Basic key performance indicators of Russian leading universities supported by government (2020 year forecast)

University	PKI <sub>1</sub>	PKI <sub>2</sub>	PKI <sub>3</sub>	PKI <sub>4</sub>	PKI <sub>5</sub>	PKI <sub>6</sub>	PKI <sub>7</sub>
KFU	99	4.0	50.0	12.0	15.0	77	53.0
MIPT	51-100	1.17	10.5	79.0	14.5	90	54.0
MEPhI	51-100	6.0	80.0	14.0	21.0	85	52.0
NRU HSE	51-100	1.8	8.0	12.0	12.0	80	35.0
NUST MISIS	80	6.2	41.0	13.0	33.0	77	84.0
NRU LSUNN	91-140	0.45	2.0	10.0	17.0	85	43.0
NSU	90-110	2.0	7.0	10.0	15.0	80	54.0
SPSPU	97	0.2	20.0	5.0	15.0	78	60.0
NRU ITMO	171	2.0	3.0	5.0	21.9	76.4	79.6
NRU TSU	51-100	12.0	30.0	10.0	15.0	75	60.0
NRU TPU	51-100	4.7	11.1	10.0	25.0	85	65.8
UrFU	100	3.4	10.5	15.0	16.0	75	50.0

According to Table 1 the majority of analyzed universities have similar ambitions for entering world leading rankings - to take up a position in QS rankings (Quacquarelli Symonds Limited) in 51-100 cluster to the year 2020. The exception is three universities that can take only 171<sup>st</sup> position (Saint-Petersburg National Research University of Information Technologies, Mechanics and Optics) and positions below 101 (National Research University Lobachevsky State University of Nizhni Novgorod in 91-140 cluster and Novosibirsk State University in 90-110 cluster). And Ural Federal University named after the first President of Russia B. N. Yeltsin is going to be in the first hundreds of world leaders (take 100<sup>th</sup> position) in 2020.

As for numerical values of basic key indicators of leading universities in some cases they vary significantly. For example, such indicators as “Number of publications in Web of Science and Scopus excluding doubling of 1 SPE” (PKI<sub>2</sub>) and “Average citation index of 1 SPE, calculated according to sum-total of publications included in data bases of Web of Science and Scopus, excluding doubling” (PKI<sub>3</sub>) differ by 60 times in PKI<sub>2</sub> (12.0 for Tomsk State University and 0.2 for Saint-Petersburg State Polytechnical University) and by more than 40 times in PKI<sub>3</sub> (80.0 for National Research Nuclear University MEPhI and 2.0 for National Research University Lobachevsky State University of Nizhni Novgorod).

Spread of values of other key indicators is less significant though there are exceptions as well. For example, in PKI<sub>4</sub> indicator (percent of foreign professors, teachers and researchers among SPE including Russian citizens who have PhD degree of foreign universities) National Research Institute Moscow Institute of Physics and Technology (State University) distinguishes significantly, it's key indicator is 79%, whereas for other universities this indicator is within 10-15% (minimum 5%).

In PKI<sub>5</sub> indicator (percent of foreign students studying basic educational programs of the university including students from CIS countries) National Research Nuclear University MEPhI excels with 33% value, whereas for the majority of other universities this indicator is about 15-20% (Communication map, 2013).

MEPhI has the biggest value (84%) of PKI<sub>7</sub> (percent of revenue from non-budget sources in university revenue structure) and National Research University Higher School of Economy has the smallest value of this indicator (35%).

Analysis of the forecast key performance indicators as a whole shows that the most probable candidate to fulfill the goal is MIPT that already in 2013 had ranking in THE and QS: it ranked in 441-450 cluster in QS ranking (general list) and entered TOP-100 in subject list of THE in physics sector (THE Physical Science) MIPT had 63 position.

Moreover among Russian universities in this ranking MIPT together with MSU took the first place. High ranking and good chances for fulfillment the goal of MIPT could be also explained by the fact that two Nobel laureates in physics of the year 2010 - Andrey Geim and Konstantin Novoselov graduated from this University. However on experts' opinion MIPT should focus on involvement of foreign students and teachers whose low evaluation indicators (11.0% and 4.0% in 2013 and 14.5% and 7.0% planned for 2020 correspondingly) conditioned by the existing system of education according to which foreign citizens could not study or teach in the University up to the year 2008 (Universities, 2013).

Moreover there were introduced such world-wide spread indicators as “Research image according to database InCites” and “Studying image according to database InCites” (both indicators are data sources for calculation of Times Higher Education WUR ranking), and also an indicator “Percent of research teachers” that is supposed to be about 50% which corresponds to world tendencies of development of science and education (MIPT Plan of actions, p. 9).

Additional performance indicators that MEPhI stated in its' development program are also of great importance for the evaluation of university performance and for formation of its' positive international image. These indicators first of all include percent of basic engineering educational programs accredited according to international standards and percent of graduates employed in nuclear sector, whose qualification was certified by control system of nuclear education quality and this indicator is supposed to reach 100%; they also include indicator of students and post-graduates percent, involved in innovation activity and scientific researches on a paying basis with about 30% value and percent of R&D revenue in total amount of university income with 46.5% value (MEPhI Plan of actions, 2013).

As for additional performance indicators of other universities under analysis the most frequent indicators are the following:

- 1) “Percent of holders of master's degree and postgraduates in the given student body” (range of dispersion for 5 universities is 20% to 55%);
- 2) “Volume of scientific researches for 1 researching teacher” the difference of values from 4.2 mln rubles per year for National University of Science and Technology MISIS, 1.7 mln rubles per year for National Research University Higher School of Economy, 1.0 mln rubles per year for Saint-Petersburg State Polytechnical University and to 0.895 for Ural Federal University named after the first President of Russia B. N. Yeltsin;
- 3) “Percent of revenue from scientific researches and R&D revenue in total amount of university income” (for 5 universities);

4) “Percent of scientific and teaching employees who finished prolonged trainings at the leading scientific and educational centers” (for 3 universities).

It is necessary to highlight that for the implementation of the key development indicator these universities has received 9 billion of rubles in total in the year 2013 and will receive from 1.1 to 1.5 billion rubles for the development in the year 2014.

## 5. Conclusion

1) Despite negative comments in foreign literature regarding uselessness of indicators of publications amount in magazines and of citation indexes in the process of performance evaluation of scientific researchers and teaching staff and in the process of formation of their rankings, in Russia these indicators are key ones for the performance evaluation of the university and individual employees.

2) Among key performance indicators of Russian universities often there is no such indicator as percentage of graduates’ employment, though abroad this indicator is considered to be one of the most important for the involvement of university entrants as well as for the evaluation of university performance. In particular the indicator of university image among employers that has 10% share in calculation of QS index is absent among key indicators (basic as well as additional) of all universities under analysis, excluding MEFPI, that took it into consideration in its development program implying it in indicator of percent of graduates employed in nuclear sector, whose qualification was certified by control system of nuclear education quality.

3) Development programs of universities also pay little attention to the value of indicator of image in academic community (does not coincide with Scopus citation index of publications in magazines without self-citation for 1 scientific and pedagogical employee during 5 years).

This indicator could have been taken into account as a part of integration and cooperation processes of universities with different sectoral research institutes of the Russian Academy of Sciences that undergo considerable changes now. In terms of reinforcement of development prospects it is important that universities use this opportunity to improve their research potential.

4) The significant problem preventing Russian universities including the most promising ones from rapid enter in the international rankings and hampering their development is low indicator of involvement of foreign students. All world leading universities consisting TOP-100 of world universities have 25% of foreign students from the total amount of students. All analyzed universities excluding two of them (National University of Science and Technology MISIS with 33% plan value and National Research Tomsk Polytechnic University with 25% plan value) plan to have this indicator at about 15% value that is clearly not enough to securely enter world rankings. Besides this indicator is composed with CIS students in mind but not with students from countries outside the former Soviet Union that are more “foreign” for Russia.

Large-scale involvement of foreign students is possible only in case of teaching in foreign languages and in English first of all, that is why universities should develop special educational programs, internationalize existing educational programs. However these tasks (and evaluation criteria as well) are not included in basic and additional indicators of the majority of universities (excluding NRU HSE which has several additional criteria of this type). Special attention should be paid to this fact.

5) To our opinion for the evaluation of universities development perspectives indicators of average age of SPE (or percent of SPE in the age of 35-55) is also important, but application programs of the universities almost do not touch upon them. However it is the existence of interested young scientists, researchers and teachers can ensure the continuity of scientific researches within already existing ones and also continuity of promising scientific schools. At this point the problem of peculiar personnel is typical for many Russian universities including ranking leader MPTI that has small amount of middle-aged teachers now (it has mostly young and elderly teachers). This problem also needs a decision.

## References

- Adnett, N., & Davies, P. (1999). Schooling quasi-markets: Reconciling economic and sociological analyses. *British Journal of Educational Studies*, 47(3), 221-234. <http://dx.doi.org/10.1111/1467-8527.00115>
- Anderson, A. (1991). No citation analyses please, we're British. *Science*, 252(5006), 639. <http://dx.doi.org/10.1126/science.252.5006.639>
- Breakwell, G., & Tytherleigh, M. (2008). UK university leaders at the turn of the 21st century: Changing patterns in their socio-demographic characteristics. *Higher Education*, 1(56), 109-127. <http://dx.doi.org/10.1007/s10734-007-9092-2>

- Breakwell, G., & Tytherleigh, M. (2010). University leaders and university performance in the United Kingdom: Is it 'who' leads, or 'where' they lead that matters most? *Higher Education*, 5(60), 491-506. <http://dx.doi.org/10.1007/s10734-010-9311-0>
- Broadbent, J., Jacobs, K., & Laughlin, R. (1999). Comparing schools in the U.K. and New Zealand: Individualizing and socializing accountabilities and some implications for management control. *Management Accounting Research*, 10(4), 339-361. <http://dx.doi.org/10.1006/mare.1999.0113>
- Communication map of NUST MISIS*. (n. d.). Retrieved December 6, 2014, from <http://www.misis.ru/Portals/0/Download/Дорожная%20карта%20НИТУ%20МИСиС.pdf>
- Competitive growth program of NUST MISIS*. (n. d.). Retrieved December 6, 2014, from [http://www.misis.ru/Portals/0/Documents/2013/8/Программа%20МИСиС\\_08062013.pdf](http://www.misis.ru/Portals/0/Documents/2013/8/Программа%20МИСиС_08062013.pdf)
- Cronin, B. (1996). Rates of return to citation. *Journal of Documentation*, 52(2), 188-197. <http://dx.doi.org/10.1108/eb026967>
- Cronin, B., Snyder, H., & Atkins, H. (1997). Comparative citation rankings of authors in monographic and journal literature: A study of sociology. *Journal of Documentation*, 53(3), 263-273. <http://dx.doi.org/10.1108/EUM000000007200>
- Garfield, E. (1955). Citation indexes for science. *Science*, 122(3159), 108-111. <http://dx.doi.org/10.1126/science.122.3159.108>
- Garfield, E. (1979). *Citation Indexing: Its Theory and Application in Science, Technology, and Humanities*. New York: Wiley.
- Goodall, A. (2006). Should top universities be led by top researchers and are they? A citations analysis. *Journal of Documentation*, 3(62), 388-411. <http://dx.doi.org/10.1108/00220410610666529>
- Lee, M. (2011). Key performance indicators for PhD education in biomedicine and health sciences. *Turkish Journal of Biochemistry*, 1(36), 60-62.
- Narin, F. (1976). *Evaluative Bibliometrics: The Use of Publication and Citation Analysis in the Evaluation of Scientific Activity*. Cherry Hill, NJ: Computer Horizons, Inc.
- Natural selection for universities*. (n. d.). Retrieved December 6, 2014, from <http://www.gazeta.ru/social/2013/07/05/5414341.shtml>
- Oppenheim, C. (1995). The correlation between citation counts and the 1992 Research Assessment Exercise Ratings for British library and information science university departments. *Journal of Documentation*, 51(1), 18-27. <http://dx.doi.org/10.1108/eb026940>
- Plan of actions for the implementation of competitive growth program of Federal State Autonomous Educational Institution of Higher Professional Education Moscow Institute of Physics and Technology (State University) among world leading scientific and educational centers for the years 2013-2020*. (n. d.). Retrieved December 6, 2014, from [http://mipt.ru/news/plan\\_5top100](http://mipt.ru/news/plan_5top100)
- Plan of actions for the implementation of competitive growth program of Federal State Autonomous Educational Institution of Higher Professional Education National Research Nuclear University MEPhI among world leading scientific and educational centers for the years 2013-2020*. (n. d.). Retrieved December 6, 2014, from <http://kpfu.ru/portal/docs/F2023573694/MIFI.pdf>
- Plan of actions for the implementation of competitive growth program of Federal State funded Educational Institution of Higher Professional Education Saint-Petersburg State Polytechnical University among world leading scientific and educational centers for the years 2013-2020*. (n. d.). Retrieved December 6, 2014, from [http://kpfu.ru/portal/docs/F1547501167/Sankt\\_Peterburgskij.politehnicheskij.universitet.pdf](http://kpfu.ru/portal/docs/F1547501167/Sankt_Peterburgskij.politehnicheskij.universitet.pdf)
- Plan of actions for the implementation of competitive growth program of Federal State Autonomous Educational Institution of Higher Professional Education Ural Federal University named after the first President of Russia B.N. Yeltsin among world leading scientific and educational centers for the years 2013-2020*. (n. d.). Retrieved December 6, 2014, from <http://kpfu.ru/portal/docs/F414946414/Uralskij.federalnyj.universitet.pdf>
- Plan of actions for the implementation of competitive growth program ("communication map") of Federal State Autonomous Educational Institution of Higher Professional Education National Research University Higher School of Economy for the years 2013-2020*. (n. d.). Retrieved December 6, 2014, from [http://strategy.hse.ru/Concurrent\\_2013](http://strategy.hse.ru/Concurrent_2013)

- Plan of actions for the implementation of competitive growth program of Federal State funded Educational Institution of Higher Professional Education Saint-Petersburg National Research University of Information Technologies, Mechanics and Optics among world leading scientific and educational centers for the years 2013-2020.* (n. d.). Retrieved December 6, 2014, from <http://5100.ifmo.ru/file/pages/9/programma.pdf>
- Plan of actions for the implementation of competitive growth program of Federal State funded Educational Institution of Higher Professional Education National Research Tomsk State University among world leading scientific and educational centers for the years 2013-2020.* (n. d.). Retrieved December 6, 2014, from [http://tsu.ru/content/viu/roadmap/TSU\\_roadmap\\_web1.pdf](http://tsu.ru/content/viu/roadmap/TSU_roadmap_web1.pdf)
- Plan of actions for the implementation of competitive growth program of Federal State Autonomous Educational Institution of Higher Professional Education Kazan (Volga region) Federal University among world leading scientific and educational centers for the years 2013-2020.* (n. d.). Retrieved December 6, 2014, from <http://kpfu.ru/cpr/ppk>
- Plan of actions for the implementation of competitive growth program of Federal State funded Educational Institution of Higher Professional Education National Research University Lobachevsky State University of Nizhni Novgorod among world leading scientific and educational centers for the years 2013-2020.* (n. d.). Retrieved December 6, 2014, from <http://kpfu.ru/portal/docs/F1030515716/Nizhegorodskij.gosudarstvennyj.universitet.pdf>
- Plan of actions for the implementation of competitive growth program (communication map) of Federal State funded Educational Institution of Higher Professional Education National Research Tomsk Polytechnic University among world leading scientific and educational centers for the years 2013-2020.* (n. d.). Retrieved December 6, 2014, from [http://tpu.ru/f/2365/\\_dorozhnaya\\_karta%20\\_russk\\_11\\_11\\_13.pdf](http://tpu.ru/f/2365/_dorozhnaya_karta%20_russk_11_11_13.pdf)
- Regulation of the Government of the Russian Federation No. 211 "About measures of government support of the leading Universities of the Russian Federation aimed at their competitive growth among the leading world scientific and educational centers".* (2013, March 16). Retrieved December 6, 2014, from <http://www.rg.ru/2013/03/25/university-site-dok.html>
- Universities received for rankings.* (n. d.). Retrieved December 6, 2014, from <http://www.gazeta.ru/social/2013/07/09/5418469.shtml>
- Visscher, A. (2001). Public school performance indicators: Problems and recommendations. *Studies in Educational Evaluation*, 27(3), 199-214. [http://dx.doi.org/10.1016/S0191-491X\(01\)00026-8](http://dx.doi.org/10.1016/S0191-491X(01)00026-8)

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