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KPI SYSTEM APPLICATION IN THE SCIENTIFIC FIELD:
OPPORTUNITIES AND LIMITATIONS

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Abstract

Each company is interested in a positive financial result. Each employee must understand what contribution he can make to the achievement of the company's goal. Companies develop incentive systems that use tangible and intangible incentive methods to achieve the above-mentioned goal. The most common system nowadays is KPI. In Russia, KPI system in the scientific field is formed by indicators of the number of publications, citation, number of received patents, and number of registered intellectual property objects. The efficiency of KPI system implementation in the scientific field of Russia is difficult to evaluate. On the one hand, there is the nominal growth of planned indicators; on the other hand, there is the decrease in the number of employees. Also, there is no analysis of the impact of the introduction of this system on the quality of publications of scientists. The KPI can lead to «overloads» of researchers and professional burnout, etc. In this regard, the introduction of KPI system into the scientific field requires a thorough study of the parameters to be used as indicators of employee performance, as well as a thorough analysis of the consequences of the introduction of this system.

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1. Introduction

1.1. Concept and history of development of Key Performance Indicators (KPI) system

Each company is interested in achieving the goal of its activities, as well as in a positive financial result (Dmitriev & Novikov, 2019). The organization uses a lot of resources during its work, but, despite universal digitalization, the company's main resource is its employees. At the same time, each employee must understand what contribution he can make to the achievement of the company's goal and be interested in effective and productive work to make the company work effectively. Companies develop incentive systems that use tangible and intangible incentive methods to achieve the above-mentioned goal (Novikov et al., 2019).

The most common system nowadays is KPI. They are the so-called goal achievement indicators, as well as the characteristics of the effectiveness of business processes and the activities of each employee. Each KPI, which is used to measure the degree to which a particular goal has been achieved, should be assigned a separate person who is responsible for achieving that indicator with established ones.

This system satisfies almost all conditions of staff motivation. It is based on management by goals, that is, ensures that each employee understands the goals of the company and the place of each person in the overall system. Employees understand how their work is related to the activities of other departments and realize the importance of the quality performance of their duties. Each person receives a motivation card, independently controls the process of solving problems, understands at what stage of achieving the goal he is and determines the size of his remuneration depending on the results of his work (Stepanova & Palatkina, 2016).

The method of assessing staff performance using KPI is based on Peter Drucker's book «The Practice of Management» (Drucker, 2015). There in 1954 he said that the most important component of the management of any organization is the evaluation of the activities of departments and the company as a whole. However, this area of management is one of the most poorly developed. Drucker was the first man who proposed the implementation of a system for assessing achievement of goals through KPI (Retivov, 2019).

In addition to his concept, there are the following KPI systems, which are the most famous among Western theories and significantly influence the formation of it:

Total Quality Management (TQM) (1970s);

Management system based on the indicator of Economic Value Added (EVA) by S. Shtern (early 1990s) (Stern et al., 1995);

Balanced Scorecard (BSC) by D. Norton and R. Kaplan (1992) (as cited in Kaplan & Norton, 2003);

Effective Progress and Performance Measurement by Adams and Roberts, 1993);

Total Performance Scorecard by Rampersad (2002) etc.

In Russia, the most popular methodology for staff incentives and motivation, where KPI are used, is the BSC by D. Norton and R. Kaplan. This system is one of the tools for implementing the strategy of the company, contributes to increasing the likelihood of its implementation and adequate assessment of the potential value of it. BSC was developed in the early 1990s by Harvard Business School's research team led by Professor R. Kaplan. It provides feedback between internal business processes and external

indicators and helps to achieve the necessary results and increase the efficiency of the enterprise (Figure 1) (Kaplan & Norton, 2003).

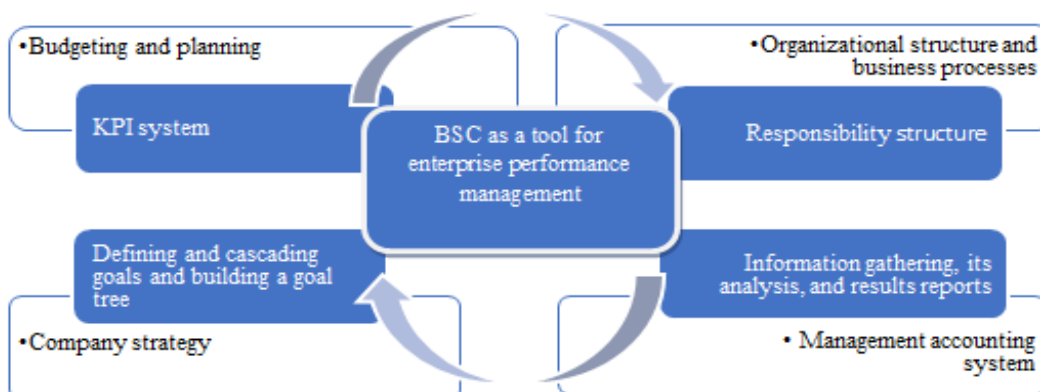


Figure 1. BSC in enterprise performance management

According to the presented scheme of BSC, there are the following company's performance criteria:

- achievement of the strategic goals of the company;
- comparison of changes in revenue and expenses for wages;
- correlation of the dynamics of employee efficiency and expenses on the remuneration system;
- change in the share of qualified employees in the total number of staff (Nikonova, 2019).

1.2. Advantages and disadvantages of implementing KPI system

The implementation of KPI system involves the use of a special mathematical apparatus that allows evaluating the contribution of each employee to achieving the goals of the organization. For each position, certain parameters are determined, the value of which the employee can and should influence in the course of his labor activity. The size of his salary will depend on the final value of these parameters: if the planned indicators are exceeded, then the employee receives a higher salary, if not, the salary decreases.

Individual KPI values for each indicator are calculated as the ratio of planned to actual ones, multiplied by 100%:

$$KPI_i = \frac{Y_{plan i}}{Y_{fact i}} \times 100\% \quad (1)$$

The total KPI of an employee is calculated as the average value of individual KPI for each indicator:

$$KPI = \frac{100\%}{n} \times \sum_{j=1}^n \frac{Y_{plan i}}{Y_{fact i}} \quad (2)$$

where n is the number of individual KPI values; i is the value from 1 to n.

The use of KPI system gives the company a lot of significant advantages. In particular, if an entrepreneur plans to scale up his business, since in large volumes the ability to «visually» monitor the dynamics of development is really impossible.

The popularity of the methodology under consideration is due to a number of advantages: it allows to determine the effectiveness of current activities; helps in the formation of plans, strategies, and forecasts;

provides timely identification of problems and helps to eliminate them; facilitates the adjustment of all business processes in general. All the described advantages allow controlling the incoming cash flow and adjust its size.

There are also disadvantages when implementing KPI: high cost, since, when the plan is over fulfilled, the employer has to pay to employees more, this fact entails a decrease in the company's profit; excessive standardization (this system limits the possibilities of creativity for employees); complexity of proper implementation, which leads to another disadvantage: formation of employees' tendency towards individualism (Parmenter, 2013).

In addition, KPI can only evaluate quantitative, but not qualitative work results. This means that in the pursuit of the right numbers, workers can neglect the proper level of service or service standards.

So, the example of the American company GameStop is illustrative. The company sells game consoles and video games and is one of the major players in this market. It has more than 7.1 thousand stores around the world. In February 2017, a retailer told how the new KPI undermine sales and force sellers to lie to customers. A program implemented by management with the name "Circle of Life" required that a certain percentage of products sold were old games and consoles. They were much harder to sell than the new ones, where KPI implementation was not difficult. To do the plan, employees began systematically telling customers that they were not bringing new products into their stores and offering them old games and consoles. As a result, product sales began to decline overall (Nosyrev, 2018).

There are the following main reasons for the negative efficiency factor results:

1) mistakes made at the stage of implementation, such as: salary reduction, setting excessive requirements, introduction of random metrics that do not take into account the specifics of a particular company, and assigning calculations to unqualified employees;

2) lack of control over the system after implementation: after the successful launch of KPI system in the organization, further control over its maintenance is necessary, regular, throughout its use, and then KPI will bring only profit regardless of the company's business area.

The above example is also indicative in that it illustrates the implementation of KPI system in trading. History shows that it is in this sphere that this system was implemented for the first time and became widespread. Sales were easy to interpret quantitatively, and their analysis made it possible to save money. However, nowadays, KPI are applied in almost all sectors of the economy. At the same time, the question of expediency of its introduction in some spheres of economy or for some company positions is widely discussed. The most debatable are professions that require creativity, as well as some professions in companies that provide for auxiliary functions, such as system administrators, as the need to document the fact of work performed can provoke excessive bureaucracy and delays in the work of core staff.

At the same time, supporters of this system insist that if we approach this tool correctly, it will be equally useful in a variety of directions: from sales to personal growth.

2. KPI system in the scientific field of Russia

Another sphere of economy, in which the introduction of KPI system is also very ambiguous, is the sphere of scientific research. Firstly, it is difficult to standardize the work of scientists. Secondly, not all the results of research activities have a positive result, it is sometimes impossible to commercialize them.

Thirdly, the state is often the customer of research. Fourthly, in the scientific field, political goals are added to purely commercial goals of design, as the level of scientific and technical development of the country is an element of the prestige of the state abroad (Novikov, 2019). For these reasons, it is particularly difficult to select KPI to stimulate and motivate researchers.

In Russia, the implementation of KPI system in the scientific field began in the late 2000s. Currently, it is widespread. Its basis is formed by indicators of the number of scientific publications (especially in peer-reviewed, including foreign ones), citation of Russian authors, number of received patents for inventions, and number of registered intellectual property objects.

According to the data of the Higher School of Economics (HSE), throughout the XXI century there was an increase in the publication activity of Russian researchers (Figure 2) (Gokhberg et al., 2019).

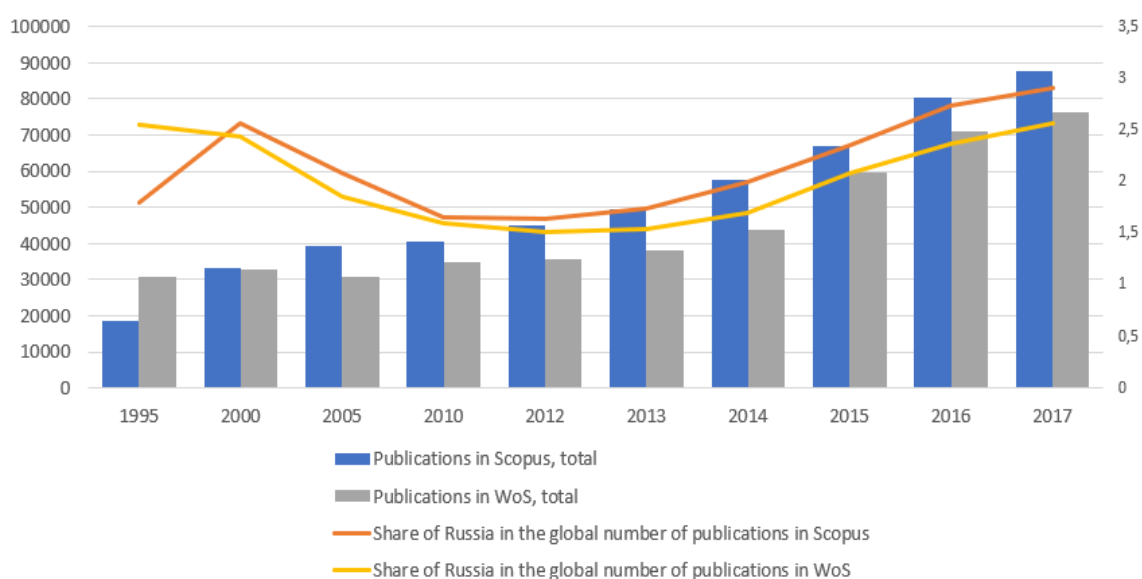


Figure 2. Number of publications by Russian researchers

While in 2000, there were published 33 401 papers (89.3% of which were articles) in the journals from Scopus and there were published 32 701 (82.7% of which were articles) in Web of Science (WoS), in 2017 there were published 87 558 and 76 369 respectively (66.9% and 68.3% respectively). At the same time, the greatest growth of publications was observed in Social sciences, while the share of publications in Natural and Exact sciences decreased significantly. Also, the observed growth in publishing activity at the global level was weaker: Russia's share in the global number of publications does not exceed 3%.

The second KPI of Russian scientists' performance is the citation of their publications. The results of scientific research should be made public, and references to scientists' works should become evidence of the author's high contribution to world science. According to the HSE, the average citation of publications of Russian authors in 2017 was 0.73 in publications from Scopus database and 0.8 in publications from WoS database. At the same time, from 2005 to 2017 there were no significant changes in this indicator. The share of citations of Russian authors' publications in the global number of citations does not reach 2%. At the same time, this indicator of evaluation of scientists' work efficiency is perhaps the most debatable among Russian researchers, as in reality it cannot testify to a scientist's contribution to the increase of

scientific knowledge, because a «failed» publication can get a high level of citations in the context of criticism.

Another indicator included in the system of efficiency assessment of Russian scientists is the number of granted patents for inventions. From 2010 to 2017 there were no significant changes in the number of patents granted in Russia to Russian inventors. In 2017, the number of granted patents was 21 037. At the same time, this number for foreign inventions has an upward trend: in 2010, 8 695 patents were granted, and in 2017 there were 13 217. Thus, there was the growth of Russia's technological dependence on foreign inventions.

At the same time, the number of registered intellectual property objects has significantly increased. Over the 12 years from 2005 to 2017 Russian specialists increased the number of registered programs for computers by 4.3 times, the number of databases by 4.7 times, the number of integrated circuit topologies by 6.2 times.

The given data can create a kind of illusion about high enough efficiency of introduction of KPI system in scientific field of Russia, after all many indicators, really, nominally grow. However, the evaluation of the effect should be much deeper. First of all, it is necessary to analyze whether the introduction of this system does not contribute to «brain drain» and staff hunger in science.

Analysis of the data showed that in the last 22 years (1995-2017) Russian science has been losing people: the total number of employees decreased from 1 061.0 thousand to 707.9 thousand and the number of researchers from 518.7 thousand to 359.8 thousand (Figure 3).

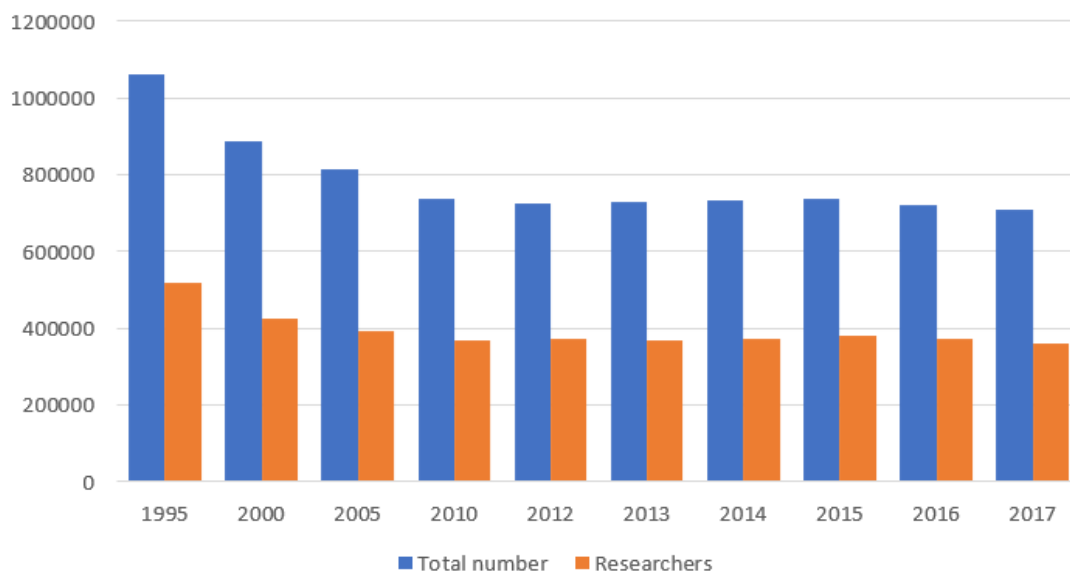


Figure 3. Number of employees in scientific field of Russia, person

Moreover, in 2015-2017, the reduction was due to a decrease in the number of employees over 50 years of age (which can be explained by objective reasons: retirement or natural causes) and employees under 29 years of age (which shows that the scientific field is not attractive for modern youth as a place of work). Thus, most likely, another «staff pit» will be formed in Russia in the scientific field, which may negatively affect the development of the branch and threaten the scientific potential of the state.

The effect of introducing KPI system into the scientific field should also be assessed for the employees. First of all, it is expressed in salary dynamics. The results of the study showed that during the period under review (2000-2017), the average salary of employees in the scientific field has been steadily increasing and amounted to 48 833.6 rubles, which is 124.7% of the average wage in the economy in 2017. At the same time, a paradoxical situation emerges when the number of employees is decreasing and the industry's attractiveness for young people is falling against the background of wage growth. This phenomenon is most likely explained by high differentiation in incomes of young researchers and renowned scientists.

3. Results

Thus, the efficiency of KPI system implementation in the scientific field of Russia is extremely difficult to evaluate unequivocally. On the one hand, there is the nominal growth of planned indicators; on the other hand, there is the decrease in the number of employees and in the attractiveness of the industry for young people. Also, in the results of research there is no analysis of the impact of the introduction of this system on the quality of publications of scientists (and this issue is now given increased attention among the scientific community, and the scales are not on the side of quantitative indicators). The situation described above with a high probability can lead to «overloads» of researchers and professional burnout, which, in turn, can lead to an even greater reduction in the number of employees, attempts to «bypass» the established rules, decrease in the loyalty of the staff of organizations, growth of conflicts in teams, etc. In this regard, the introduction of KPI system into the scientific field requires a thorough study of the parameters to be used as indicators of employee performance, as well as a thorough analysis of the consequences of the introduction of this system.

4. Conclusions and discussion

Thus, KPI system is one of the most effective tools of top management, which allows making changes in the company and leading it in a new direction. KPI system has been proving its effectiveness in Western companies for over forty years and in Russian companies for over twenty years. However, such a management tool, if used incorrectly, can lead to chaos if KPI do not accurately transform an organization's strategy or goals.

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