System of Internal Monitoring of Performance of Indicators of Efficiency of the University

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ABSTRACT

Strategic planning of the university is one of the tools for monitoring the effectiveness of educational institutions of higher education of Ministry of Education and Science of the Russian Federation. The paper considers the approach of South-West state university to the organization of the system of internal monitoring of performance indicators of strategic development. The authors have proposed theinfological model "entity-relation» of the system and the formula for evaluating the performance of departments and faculties of the planned values of indicators . This formula takes into account that if the university is not assigned to perform any indicator, it does not reduce its final rating score. The sequence of entering information into the system by structural units is described. The core of the system is a multi-user client-server program created using 1C: Enterprise 8.3 platform based on the database of scientific and educational publications and intellectual property of university employees. The main interfaces and roles of the system, an example of calculating the rating of faculties using the developed software are given. The introduction and development of the system from 2012 to the present contributes to the achievement of the strategic development indicators of the university, the performance monitoring indicators of the performance of universities of the Ministry of Education and Science of Russia, the entry or promotion of the university in various national and international ratings.

Key words: efficiency, university, infological model, software, strategic development, database.

1. INTRODUCTION

Improving the effectiveness of the university as a result of using the resources at the disposal of the educational organization is currently a key aspect both for passing control measures by Ministry of Education and Science of Russia and Federal Education and Science Supervision Service, for positioning in Russian and international ratings, and for implementing the Decree of the President of the Russian Federation of May 7 2012 N 597 "On measures to implement the state social policy" in part regarding the increase in average wages of teachers and researchers of higher education institutions up to 200% of the average salary in the region in which the corresponding institution is located.

Accordingly, in modern conditions, each university organizes activities in such a way as not only to meet the requirements for licensing and accreditation of basic educational programs, but also to increase positions in leading Russian and international ratings, to fulfill the criteria for monitoring effectiveness of Russian Ministry of Education and Science and the order of Russian Ministry of Education and Science of 23.01 .2018, No. 41. One of the tools of such an organization is the development and implementation of strategic development programs by universities.

At South-West State University, the strategic development program was approved in 2012, modified in 2016 and 2019. The effectiveness of the program is estimated annually as the fulfillment of the target indicators characterizing the main areas of the university (quality of education, employment, admission, scientific achievements, financial and economic results, etc.)by the departments, faculties and other units. At the same time, the rating of faculties and departments is built, which determines the internal distribution of resources for future strategic periods (for example, the allocation of an annual bonus for employees).

A review of studies on the stated problem showed that the importance of performance management of the university is justified [1], the issues of creating models and software for modeling, forecasting and monitoring of performance indicators of the university for external evaluation are considered [2, 3], it is shown the necessity and effectiveness of

management automation of the activities of the university [4], including using neural networks [5], the approaches to increase certain important indicators (publication activity, average USE score) are considered [6, 7], the methodology for evaluating the activities of departments is proposed [8], the effectiveness of using the rating to stimulate the work of university departments has been demonstrated [9]. At the same time, special attention was not paid to the development of monitoring systems for internal indicators of strategic development of the university and their impact on external evaluations.

2. PURPOSE OF THE STUDY

The purpose of this work is to generalize the experience of creating and implementing an internal monitoring system for the implementation of indicators of the strategic development of the university and its role in improving the effectiveness of the university for external evaluation.

3. MATERIAL AND RESEARCH METHODS

As research methods, we have used a systematic approach, a theory of database design, and a method of expert assessments. Materials for the study were obtained on the basis of the activities of the South-West State University (hereinafter - SWSU) in 2012-2019.

4. RESEARCH RESULTS AND DISCUSSION

Every year the university approves a list of indicators of the strategic development program and their target values for each faculty of the university. The effectiveness of the university in this case is defined as the effectiveness of achieving all the planned values of indicators by all faculties. Planning the target value of each indicator both for the university as a whole and for each faculty (Institute) is a separate organizational and technical task, the solution of which is aimed at fulfilling the external requirements for the university by achievable and rational distribution of the total value between individual structural units. So, for example, planning of admission is a function of the allocated number of budget places, the necessary amount of financial income from

extra-budgetary students, the potential employment of graduates, etc.

Each faculty, by analogy with the university, distributes the planned values of indicators between departments, and those, in turn, assign specific indicators to individual employees (if necessary).

The collection of information about the current value for each structural unit of indicators is carried out by the relevant structural units of the university.

Based on the results of data collection, the current rating of structural units is built. To evaluate each unit, the formula is used:

$$R_j = \frac{\sum_{\forall j: p_{ji} \neq 0} w_i \cdot min\left(F_{max}, \frac{f_{ji}}{p_{ji}}\right)}{\sum_{\forall j: p_{ji} \neq 0} w_i} \tag{1}$$

where
i-index number, j-Department (faculty) number);
R_j-evaluation of the j-th Department (faculty);
w_i-weight of the i-th indicator;
f_{ji}-the actual value of the i-th indicator for the j-th Department (faculty);
p_{ji}-planned value of the i-th indicator for the j-th Department (faculty);
Fmax - the maximum possible overfulfillment of the indicator by the unit, for which the score increases. This value cuts off cases of non-optimal indicator planning; for example, in 2018 at SWSU this value was taken equal to 2 (the unit that has performed the indicator by more than 200% does not gain an advantage in building the rating).

A unit that fulfills 100% ofall planned indicators will receive a score of 1. The maximum possible value of the score is Fmax.

An example of strategic development indicators used at South-West State University, their weight coefficients, determined by the method of expert assessments, as well as their relationship with some external indicators taken into account when constructing various ratings and monitoring, are shown in table 1.

Table 1: Example of the strategic development indicators of SWSU in 2018

Indicator (*i*)	Weight w_i	Plan p_{ji}	Fact f_{ji}	Interrelatedexternalindicators
1.13 Average exam score of full-time students admitted to the first year without taking into account the target set	0.5	60.7	60.7	E.1 Educational activities (monitoring the effectiveness ofMinistry of Education and Science of the Russian Federation)
2.33 Number of published articles indexed in Scopus, units	1.0	402	204	Citation of teachers (international ratings THE, QS)
2.34 Number of published articles in journals recommended by Higher Attestation Commission	1.0	872	709	Universities demand rating in Russia ("Russia today»)
2.37 Number of patent applications, units	0.25	149	136	Rating of inventive activity of universities ("Expert RA»)
1.23 Share of the number of graduates employed in the calendar year following the year of graduation	1.0	80	74.83	E. 6 Employment (monitoring the effectiveness of Ministry of Education and Science of the Russian Federation), Universities demand rating in Russia ("Russia today»)
2.21 The amount of funds received from all activities (except for basic educational programs)	1.0	174	112	E. 4 Financial and economic activities (monitoring the effectiveness of Ministry of Education and Science of the Russian Federation), The decree of the President of Russia of 07.05.2012 N 597
1.12 The number of foreign students enrolled in the first year	0.25	220	297	Share of foreign students (international rankings THE, QS)

According to the formula (1), faculties or departments, as well as individual university employees can be ranked. In formula (1), it is taken into account that if a university does not plan to carry out any indicator, this does not reduce its final rating score.

An example of calculating the rating of university departments according to formula (1) using the developed software is given in table 2.

Table 2: Example of SWSU faculty ranking in 2018

Item	Faculty	rankingscore
1	Facultyof Natural Sciences	1.07138
2	Faculty of Economics and Management	0.95927
3	Faculty of Mechanical Engineering	0.91377
4	Law Faculty	0.89198
5	Faculty of Fundamental and Applied Information Technologies	0.86170
6	Faculty of Civil Engineering and Architecture	0.84626
7	Faculty of Linguistics and Cross-cultural Communication	0.81853
8	Faculty of Public Management and International Relations	0.76673
9	Institute of International Education	0.51663

The main entities of the infological ER-model of the developed monitoring system are presented in Figure 1. The model is created in the Dia program.
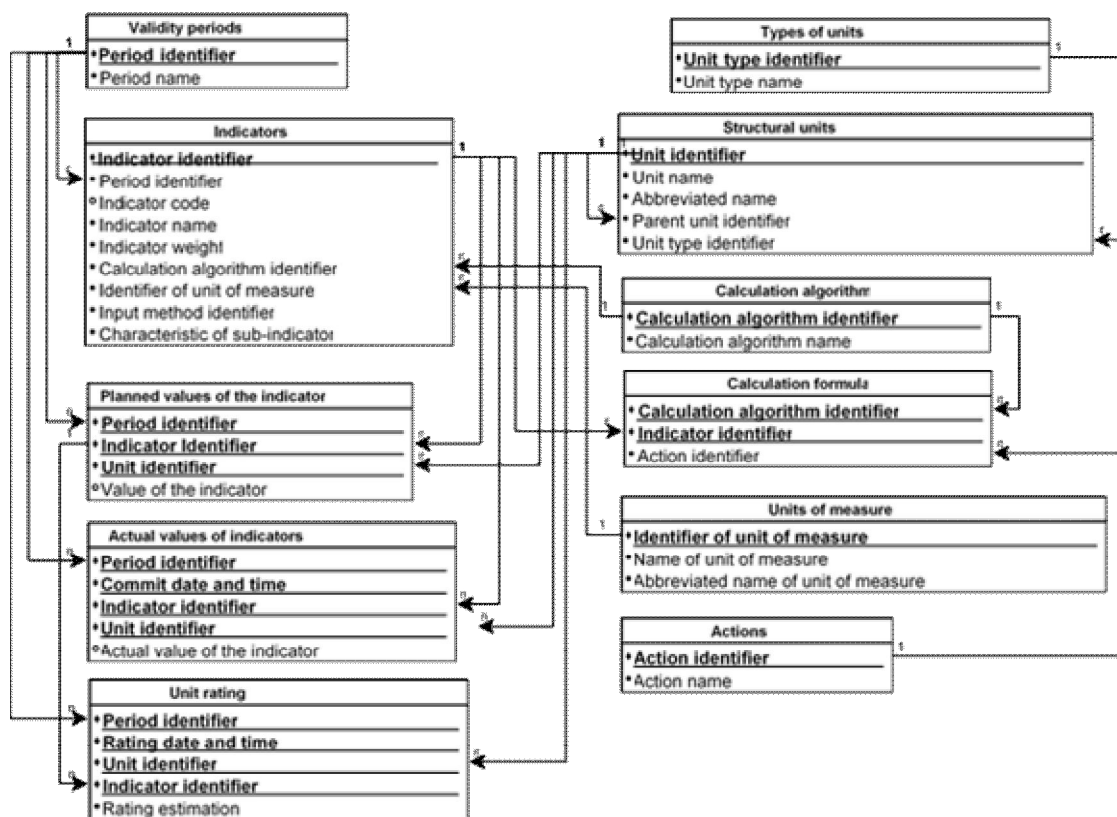
Figure 1: Fragment of the ER-model of the developed monitoring system

The model provides the ability to collect the history of changes in the values of indicators to track the dynamics of their changes in individual structural units and the university as a whole.

In the original version of the monitoring system we used documents created in Microsoft Excel as a data collection tool. Data processing was performed using Visual Basic for Applications (VBA) macros. Since 2018, the software part of the monitoring system has been redesigned as an addition to a proprietary design database created using the "1C: Enterprise 8.3" technology platform to take into account the publication activity and intellectual property of university employees and students. Integration with the existing system made it possible to record information automatically on indicators related to the number of publications in journals from the list of HAC, publications indexed in Scopus and Web of Science, the number of patents obtained, published monographs, manuals and textbooks. It was also automated the transfer of information on the performance of indicators related to the admission to study at the university (the number of accepted russian and foreign students and graduate students, the average exam score by departments and faculties) from the corresponding subsystem of the university [10].

The choice of the 1C: Enterprise 8.3 platform is justified, firstly, by the availability of the required number of licenses at the university (both server and user), secondly, by the possibility of easy integration and data exchange with other subsystems of the university, and thirdly, by providing the client -server, multi-user mode of operation and cross-platform application (most users work with the system using a conventional browser).

For entering and analyzing data, 4 types of interfaces and corresponding roles (sets of access rights) are implemented: "View information", "Faculty", "Unit", "Administrator". The View Information role allows departments and other units to become familiar with the current monitoring situation in read-only mode. The role of "Faculty" additionally allows you to distribute target values of indicators between subordinate departments, get acquainted with the current rating, and interactively compare the results of various departments for individual or all indicators. The role of "Unit" additionally allows you to make indicators in the context of time. The role of "Administrator" allows you to plan the values of indicators throughout the university, change the parameters of rating construction, and generate statistical reports (see Figure 2).

"The program for planning and analyzing the performance of indicators of the strategic development program of the university" is officially registered in Russian Federal Agency for Intellectual Property, Patents and Trademarks in the prescribed manner (certificate of registration of the computer program RUS 2018664944 10/17/2018).

Figure 2: Fragment of the "Administrator" interface of the developed program

5. CONCLUSION

Thus, the paper describes the structure of the system for monitoring the performance indicators of the university, formed at the South-West State University in 2012-2019. The introduction of such a system contributed to the achievement of the strategic development indicators of the university and, accordingly, the performance monitoring indicators of the performance of universities of Ministry of Education and Science of Russia, the preservation of the position of South-West State University in the top 100 Russian universities in various national ratings since 2012 (the university is included in the top 100 of the Expert RA annually ", rose from 7th place to 3th among classical universities in the ranking of demand for universities" Russia Today ", etc.), and also stimulated the university's entry into prestigious international QS ratings in 2018 BRICS (301-350 place), QS EECA (201-250 place).

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