

Rating System for Personnel Professional Effectiveness: Principles, Models and Algorithmic Modules

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Abstract—General problems connected with the design, introduction and application of a rating system for personnel professional effectiveness are analyzed. The technology of the design of such a system is developed with the purpose of ensuring the effectiveness of the development and application of a corporate rating system and also to ensure the reliability of rating estimations generated by it. The automated rating system for the definition of personnel professional effectiveness passed successfully a primary approbation by the example of a “technical college teaching staff” social group and may be recommended for the adaptation to the investigation of social group experts under conditions of enterprises and manufacturing companies.

Keywords— rating system, professional effectiveness, models, algorithmic modules

I. INTRODUCTION

At present the problem of personnel estimation is urgent for various types of companies, industrial plants and manufacturing companies [3, 12, 20], and also for colleges [8, 9, 11]. For the development of a personnel estimation system and staff rating formation there are used different methods [1, 4, 10, 13, 14, 15] which allow taking into account not only general approaches to the solution of this scientific problem [2, 6, 19], but also a specificity of different companies, for example, that of higher education institutions [5, 7, 16, 17].

The significance of the development of efficient and reliable methods and systems for teaching staff professional activities estimation is confirmed by many years’ practical experience in the management of higher education institutions in many countries of the world (the USA, Great Britain, Germany and others). Since the 90-ies of the last century such systems for the estimations are used actively in higher education institutions of Russia. For the present the qualification estimation of scientific – teaching staff is one the most significant signs of modern university maturity.

II. COMMON MODEL OF DESIGN STAGES FOR RATING SYSTEM OF PERSONNEL PROFESSIONAL ACTIVITIES (RS PPA)

On the basis of the experience of Russian educational institutions we will carry out the estimation of an influence

level of design technology and a rating system introduction upon reliability of rating results generated by it. On the official sites of many Russian higher education institutions which at present use already rating systems one can find various corporate documents belonging to the problems of the development and functioning of these systems. Among these documents we can emphasize first two types of documents: “The order of rating system development and its introduction” and “The regulations on teaching staff professional activity rating”. The analysis of these documents allows concluding that the processes of design and introduction of rating systems in various colleges do not contain significant differences and may be presented as a common procedure for the design of an intra-college rating system (Fig. 1).

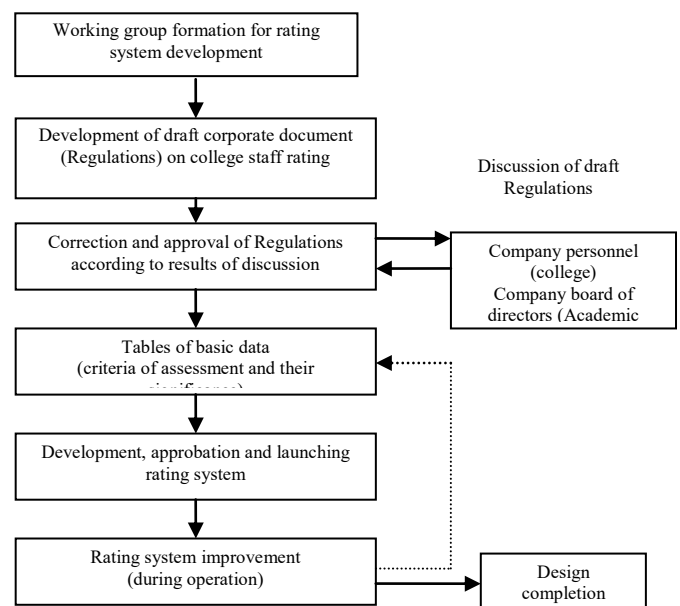


Fig. 1. Common model of stages in the realization of rating system development for personnel (college staff) professional activity.

Having obtained an assignment for the development of a rating system a working group begins, as a rule, to retrieve an information on the analogues of such a system in a suitable college (technical, humanitarian, medical or other). As it was

already mentioned above, suitable Regulations on rating approved and served as a basis for a rating system in certain colleges one can find in the Internet. Changes introduced by a working group in an analogue of the Regulations on rating are most often limited to the correction of the assessment criteria list on its contents or significance. The apparatus for rating computation and a form to carry out an assessment are practically permanent. And it is for this reason the Regulations on rating are very similar to each other.

The discussion of the draft Regulations by college staff and the Academic Board of a college also emphasizes the contents and significance of rating criteria. At the same time the question on a correction check-up in rating which will be obtained on the basis of the document (Regulations) approved is not even raised. The absence of the formulation of such a question witnesses either to a formal approach to the development of such a system, or to incompetence of the highest management of a college in the problem under development as the reduction of different data on staff activities to a single rating is carried out with the aid of empiric formulae. It is possible to assume that the correctness of a mathematical apparatus is not doubted for that simple reason that as a basis of the Regulations on rating is taken a certain analogue used in a proper rating system already introduced. Somehow or other, but the sequence of the stages of discussions and the adoption of the Regulations on rating system inclines the authors of its software modules to particular attention to modules ensuring various manipulations with tables of source data to obtain rating assessments. The rating system developed in such an order is being passed approbation and during this approbation is carried out the search of errors and their elimination in software modules whereupon the system operation begins.

Such a procedure of the development, introduction and operation of a college rating system does not take into account at all the possibility of incorrect rating assessments occurrence [1]. The incorrect rating assessments given by a system to some colleagues may appear and, accordingly, may not be noticed at once. To carry out their purposeful research first it is necessary that all college employees whose assessments are foreseen in a rating system introduce all essential data of their work. The lists of rating assessments obtained after that must be checked up by experts with the purpose of the identification of colleagues whose rating assessments from their point of view either too high or too low.

In practice, to speed up this process it should be expedient to analyse rating assessments of employees of the highest category (Doctors of Science and Professors). In this case incorrect rating assessments should be sought in the upper part of a rating list where among well-known persons due to their activity may appear the names of colleagues not remarkable at all from the point of view of college leadership.

At first, it is possible to suppose that the reason for the occurrence of such rating assessments consists in errors in source data used for the computation of rating assessments. If the examination of source data confirms their authenticity then unfair rating assessments can be considered as a consequence of errors made at the development of software modules of a

rating system.

And only a complete verification of rating computation and a comprehensive comparison of source data and rating assessments obtained may help in the investigation in that the reason of an incorrect rating assessment is hidden in a mathematical apparatus used for rating computation.

When a real reason of incorrect assessments occurrence is determined the designers of a rating system must update in a proper way a mathematical apparatus used by them for a rating computation. Here the complexity consists in that it is unknown in advance in what way a model of rating computation should be changed to exclude a possibility of unjust ratings. Here it is necessary to carry out a lot of experiments including changes in formulae for rating computations, re-calculations of rating assessments and the comparison of results obtained.

But, in a common procedure of a process there is foreseen a minimum set of tools for updating an apparatus of a rating computation: means for changes in criteria composition for the assessment and correction of their significance. These resources cannot ensure a search of acceptable options of criteria groups on kinds of activities, necessary for obtaining a correct model of rating computation [1].

In such a way, at the use of a common procedure of design the necessity of considerable changes in the model of rating computations can arise after the completion of its design and the introduction of the whole of a system. And it is possible to solve this problem efficiently only in that case, if the whole of tools necessary for this was initially foreseen in the design of a rating system.

Thereupon for the authors it seems to be necessary the creation of a technology for rating system development defining a list of obligatory modules of a rating system their basic characteristics and also a clear sequence and contents of stages of the fulfilment in the development and introduction of a system.

III. BASIC PRINCIPLES FOR DESIGN OF RATING SYSTEMS OF PERSONNEL PROFESSIONAL ACTIVITIES (RS PPA)

At the development of this technology we used a number of principles of a system approach to designing (integrity, structuring, system hierarchy).

According to the principle of integrity a rating system for the assessment of college teaching staff professional activities should be considered not only as an integral object carrying out functions vested in this object, but also as one of the sub-systems for monitoring college functioning.

Inasmuch as a process of obtaining essential information serves as a basis for the fulfilment of any kind of monitoring, a basic element for a rating system (which it uses jointly with other kinds of monitoring) is a system of information gathering regarding professional activities of the college personnel. From the point of view of the principle of structuring the development of a rating system is not an end in itself, but it must submit to the best performance of its functions in the structure of college management:

substantiated managing decision-making and the motivation of teaching staff activities.

And, finally, in accordance with a hierarchy principle the technical requirements to the modules of a lower level of a hierarchy are formed on the basis of summary requirements of modules with the hierarchy of a higher level.

IV. ORGANIZATIONAL MODEL OF RS PPA DESIGN

Considering a rating system design as a design of one of the elements in the monitoring system of college functioning the authors have obtained thereby a number of practical advantages manifested both in the development of a rating system, and after its introduction. In particular, such an approach contributes to the effectiveness achievement in activities of personnel responsible for the preparation of monitoring information in college structural sections inasmuch as they have no need any longer to fill in various reporting forms containing data repeating mainly each other. The effectiveness of work is provided at the expense of that the whole of data of college personnel activities which could be required for carrying out various sorts of college monitoring are registered in a database only once. It saves working time of college employees since all they need to do is to enter regularly in the database the information of the completion of various works. As to the rest of work with the information (including summing up the work done for rating definition) then corresponding software modules assume this work completely.

Starting designing a rating system it is necessary to comprehend that the development and introduction of a basic system of information gathering concerning college staff activities are to be completed before the beginning of mathematical apparatus development used for rating computation. It is conditioned on the need of carrying out the verification of a model of rating computations on the basis of actual data of college staff activities.

In such a way, the design of a rating system should be divided into two successive stages. In the first stage there is created and introduced a basic system allowing accumulating all essential information used for carrying out various kinds of college monitoring (Fig. 2). The existence of such a system allows verifying alternative options of a mathematical apparatus used for obtaining rating assessments and creating a rating system ensuring rating assessment reliability.

It should be emphasized the significance of the regulation of that the functional potentialities of a basic system of information gathering must be defined with information needs of system-users of this information (hierarchy principle). So, for the solution of rating problems of college teaching staff professional activities and for carrying out other kinds of college monitoring the modules of information gathering systems must ensure:

- The information completeness on various categories of works done.
- The possibility of data classification of works on signs used in various kinds of monitoring.

- The assurance of maximum accuracy of the information gathered.
- The data protection from unauthorized access, changes or deletion.
- The simple mechanism for the extension of a list of works registered facilitating a system functioning tracking.

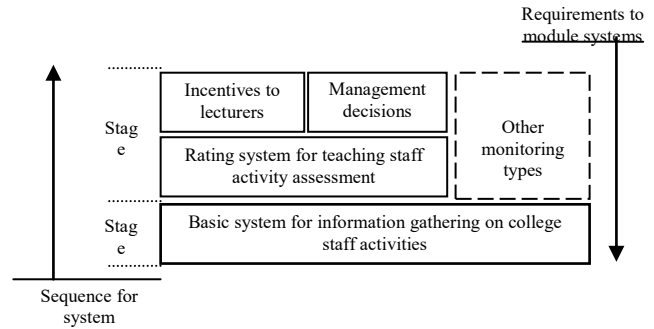


Fig. 2. Organizational model for rating system design

Having obtained actual data of college teaching staff activities one can pass to the design and verification of a mathematical apparatus used for rating computation.

This process is supposed to use alternative variants of empiric formulae which, as it is supposed, could be used for rating assessments obtaining and a further comparison the results of their application on the same sets of source data. Thereupon, the modules of a rating system are to ensure a simultaneous use of different models for rating computations and a possibility for the comparison rating lists corresponding to them. Furthermore, inasmuch as it is unknown in advance how many options of a mathematical apparatus for rating computation have to be tried before an acceptable option will be found, the modules of a rating system must present flexible tools for the modification of a rating computation procedure. It is inexpediently here to realize every new procedure of rating computations as a new software module in view of possible errors in programming in every new software module. The consequence of such errors may be a wrong conclusion about the incorrectness of one of the variants of mathematical apparatus which could be used altogether for the computation of rating assessments. For the avoidance of similar collisions for the simultaneous use of different variants of mathematical apparatus for rating computations it should be useful to develop a language for the description of a rating computation procedure allowing the creation, changing and use in computations formal descriptions of different procedures for rating definition. At such an approach a rating computation through any alternative procedure is realized in one and the same software module which carries out a load and interpretation of a formal description of a procedure directly in the course of the rating assessments computation.

V. ALTERNATIVE MODEL ADVANTAGES IN RS PPA DEVELOPMENT

The formalization requirement of a rating computation procedure at the design of a rating system has an

organizational character. It is imposed only to ensure a workability of a verification process of a mathematical apparatus used in a rating system, whereas basic requirements to functional potentialities of a rating system (Fig. 2) are to be formulated reasoning from the requirements of system-users of rating information.

First, let us dwell upon the requirements to a rating system from the direction of a system of material and moral incentives for college staff. In corporate documents (Regulations) on college rating analysed by us there is declared a necessity of rating system use as a basis for the formation of a system for personnel material incentives. But the design processes of these two systems initially do not interact at all: first, a rating program is developed and then its potentialities adapt themselves to the organization of staff incentives. From our point of view such an approach is admissible only at the use of the simplest forms of material encouragement, for instance, by means of one-time bonuses for a few best (according to rating) lecturers according to the results of an academic year or an official one. Just this form of encouragement is used in most of Russian colleges which use rating forms during many years.

But there is a need often enough in more complicated forms of encouragement when a considerable part of a remuneration for labour depends directly upon the results of employee's labour. Under such conditions a rating system could become a basis for the creation of a flexible system for the definition of an incentive allowance to a salary embracing not only lecturers, but also the majority of college staff. For these purposes in a rating system there must be envisaged some corresponding functional potentialities. Let us dwell upon them more thoroughly.

A modern college offers various forms of training and integrates specialists training often enough in different systems of education. In this connection college lecturers are included in different ways in problem solutions on rendering educational services and, consequently, their work is characterized by sets of rating criteria different from each other. From this it follows that under current conditions for the formation of a flexible system for material encouragement using as source information that from a college rating system the latter must be able to estimate separately the results of professional activities in different groups of college staff and use at the same time different sets of rating criteria.

Besides, a time interval used most often is inadmissibly large for rating re-computation (with one year duration). This limitation is evidently introduced in connection with the use of the technology of source data gathering and a preparation for rating computation supposing a questionnaire survey of participants in a rating procedure.

But, if we change the technology of data gathering and preparation we use a basic system of information selection about college staff activities as a basis of a rating system, then in this case the removal of any limitations for the duration of a period for rating re-calculation does not face any technical difficulties.

For the application of the system of material encouragement influenced in a positive way the growth of the professional level of college teaching staff it is necessary that the justice of rating assessments given by a rating system would not cause any doubts. Here it is not enough to develop a correct procedure for rating computation. It is necessary also that any college employee could check up source data for rating computation and could compare rating computations of different colleagues and make sure in the justice of a personal rating value assigned to him.

There are also other forms of intra-college monitoring which are not connected with the formation in a college a system of a material and moral incentive and which can be carried out with the use of a rating system (for instance, the analysis of results of some college employees activities at management decision making). In order to carry out them in a rating system there must be envisaged tools which allow obtaining extracts from rating-lists containing rating assessments on separate groups of lecturers (employees) or on separate kinds of their professional activities.

In such a way, taking into account the requirements of system-users of rating information the modules included in the structure of a rating system are to ensure:

- The possibility for the creation and simultaneous application of various options of an apparatus to obtain rating assessments.
- The completely automated computation of rating assessments (a possibility to obtain daily updates of ratings of person assessments).
- The possibility for college employees rating computations carried out both taking into account their common contribution to the work of an educational institution, and according to the results of their activities in the course of any limited time interval.
- The process openness in rating assessment computations providing a possibility of source data control for rating computations and all other interim reports.
- The possibility for rapid obtaining data from tables of rating assessments with the use of combined criteria in an extraction.

The technology of a rating system design considered by us provides the process of its development with a clear plan of actions contributing to the formation of an effective and reliable system. This technology observance also allows avoiding possible psychological problems connected with the introduction of a rating system for professional activities in a college staff. Indeed, at the first stage of a rating system development the introduction of its basic component (systems of information gathering on college staff activities) must be apprehended positively by a corporate community as this component to a great extent spares college staff the necessity to prepare various and frequently similar in a structure reports on proper professional activities. For example, (for Russian colleges) it can be promoted by an automatic preparation of annual reports on scientific research work of lecturers, departments, faculties and a college as a whole.

When a period of basic system debugging is over and the information on staff activities begins its registering regularly in a database it is possible to pass to the development and introduction of rating system modules responsible directly for the computation of rating systems. At such a sequence of the development a reason for a possible negative perception of a rating system by college community is excluded as the introduction and operation of its modules do not impose any additional duties on college staff. As a result the introduction of a rating system can bear a purely familiarization character, when lecturers and employees of a college are informed that in a college there is introduced a rating system and accessible for use for their professional activities assessment.

VI. CONCLUSIONS

The considered principles, models and algorithmic modules were approbated successfully at the development of a rating system for the assessment of the effectiveness of staff professional activities under conditions of some Russian colleges. The introduction of such systems allowed the leaders of the departments of colleges to reduce time for reporting documentation preparation by 20% on average, and the administration to increase a validity and effectiveness of functioning a system of professional activity encouragement for the staff. The adaptation of modules of professional activity types and procedures for rating computation to the conditions of other types of organizations and also enterprises and manufacturing companies will allow proving the effectiveness of use of such an approach for the optimization of the function effectiveness of similar systems formed with the use of models and algorithmic modules developed by the authors.

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