

EXPERT SYSTEM OF INDIVIDUAL PERFORMANCE EVALUATION OF EMPLOYEES

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Abstract: The monitoring of performance and positive motivation of employees has great influence on increasing the performance of institutions or workplaces. This applies to private, public and state institutions alike. One such institution is a public university. However, all available and so far developed systems make possible only partial employee evaluations. To our knowledge, no complex and objective individual assessment system is as yet available.

This was the main reason for which we decided to elaborate a completely new individual assessment system that makes possible the evaluation of employees of a given institution complexly or in selected categories pursuant to selected areas. The basis of the system is an original formula for the total calculation of an individual's performance.

The individual's results in the various areas are related to the average value achieved in the given area in the compared set, multiplied by the respective weighting coefficient of the area.

The goal of the presented paper is the introduction, development, description and presentation of a new and original system which will allow for the complex assessment of a chosen employee or group, and which has been applied at the Faculty of Mechanical Engineering, Slovak University of Technology in Bratislava in Bratislava, (STU BA).

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Introduction

The known available systems of individual performance evaluation of employees make possible only partial employee evaluations, (Heneman, 1972), (Rynes, 2005), (Rafikul, 2006), (Shields, 2015). To our knowledge, no complex and objective individual assessment system is as yet available.

The proposed system has a number of specific properties which no one of the known systems, which guarantees originality in the given area, has. Parameters such as motivation, flexibility and complexity or universality belong here.

Description of the system

Complexity

The mathematical model is the sum of the proposed criteria that are multiplied by weight coefficients. The resultant performance of the employee is calculated according to the following relation (1), (Šooš, 2017).

$$P_{i_emp} = \frac{Hour_{i_emp}}{\emptyset Hour_{groups}} * k1 + \frac{Points_{i_emp}}{\emptyset Points_{groups}} * k2 + \frac{Points_{i_emp}}{\emptyset Points_{groups}} * k3 + \frac{Points_{i_emp}}{\emptyset Points_{groups}} * k4 \quad (1)$$

In the individual assessment of the employees of our institution, we selected performance areas such as pedagogy, science and research, publication outcomes and a final evaluation area known as "other activities" which are put into the evaluation by the head of the relevant department or workplace, according to precisely defined activities, Tab. 1. These values for the individual areas enter the system completely automatized on the basis of actually achieved outputs.

Evaluated area	Pedagogy	Science and research	Publications	Other activities
Significance coefficient	k1	k2	k3	k4
Selected group	0.35	0.35	0.2	0.1

Source: Šooš, 2017

Pedagogy

In connection with the function position of the teacher, pedagogical performances are evaluated for four reciprocally independent groups - professors, associate professors, specialist assistants and researchers. The evaluation of pedagogical performances in year n, expressed in hours per week during a semester (h/week), is related to the two preceding calendar years, with the arithmetic average of performances in the evaluated years taken into account. Pedagogical performances are divided into direct pedagogical and indirect pedagogical processes. Lectures and exercises form parts of direct education. Their significance is differentiated according to their type and the degree of university education. Examining

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bachelor works, semester projects, diploma works and pedagogical performances within the 3rd degree of study form parts of indirect education. The pedagogical performance of a teacher/researcher is the sum of his pedagogical performances within direct and indirect education, (Šooš, 2017).

Science and research

The science and research area takes into account the results achieved, particularly in project activities, and this by obtaining, leading and solving projects. A differentiated approach to the evaluation of projects according to importance, both domestic and international, is applied. Enterprising activity, contracts on work and the like are also calculated into the evaluation. A sample of the evaluated performances is presented in Table 2.

International projects – research programs (e.g. RP, H2020, Interec ...)	
*Submitting and receiving the project	150 b
Leading the project	50 b/year
* Solving the project	200 b/50 000 EUR/ year
International projects - mobility (Erasmus+, APVV, ...)	
*Submitting and receiving the project	25 b
Leading the project	15 b/ year
* Solving the project	50 b/ 62 000 EUR/ year
Grant projects - APVV	
* Submitting and receiving the project	25 b
Leading the project	20 b/ year
* Solving the project	50 b/ 62 000 EUR / year
Other – enterprising activity	
Receiving the project	10 b
* Solving	10 b/10 000 EUR / year
Other - other projects	
* Submitting project	5 b
Receiving the project	5 b
* Solving the project	10 b / 15 000 EUR/ year
* The share of the individual employees in submitting or receiving the project is determined by the relevant project leader by a percentual expression.	
Source: Šooš, 2017	

Publications

A quantitative assessment of performances rests to a maximal degree on the Ministry of Education, Science, Research and Sport of the Slovak Republic criteria of application for the assessment of publication performances as the bases for the purposes of distributing subsidies from the state budget to public universities. The proposed rules for the assessment of outputs in the area of publication activity also take into account the criteria of the Accreditation Commission applied in the process of accreditation of universities.

Points from the publications are determined by calculations according to the allocated financial resources which the institution receives from the Ministry for publishing individual types of publications. The highest financial valuation is given to Current Contents publications and patents or utility models. For example, for 2018 this was 5037 Eur. For this maximum sum are allocated 100 points. Other publication outputs have their point value allocated in proportion to this value. In the manner points for the individual types of publications were later automatically allocated. An example of allocated points is illustrated in Table 3, (Podklady k publikačnej činnosti, 2019). We added points for citations, Tab. 3. to the point system. The points are automatically calculated to the affected person after the registering of the work in *AIS*.

Other activities

The head of the institute evaluates all other activities that are not included in the first three areas. For the most part these are activities, which indirectly share in publicizing and enhancing the good name of the workplace or faculty. An example of points added for certain activities is illustrated in Table 4.

Table 3: Point assessments of research activities

Description	Points
AAA, AAB, ABA – Scientific monographs and scientific studies in journals issued abroad or with domestic publishers in world or other than world languages,	47
ACA, ACB – University textbooks issued abroad and with domestic publishers	21
ADC, ADC, ADD – Scientific works in foreign and domestic current Contents journals in world or other than world languages	100
AFA, AFC – Published invited papers from international scientific conferences in world or other than world languages	8
AFB - Published invited papers from international scientific conferences in world or other than world languages	4
BCB, BCI – Textbooks for secondary and elementary schools, scripts and educational texts	21
AFE, AFF - Abstracts of published invited papers from international and domestic scientific conferences	2
AGJ – Authorial certifications, patents and discoveries	100
BAA, BAB – Specialist book publications issued in foreign or domestic publishers	21
BDC, BDC, BDD, BDD - Specialist works in foreign and domestic Current Contents journals in world or other than world languages	100
BDE, BDF - Scientific works in foreign and domestic other journals in world or other than world languages	1
BDM - Specialist works in foreign journals registered in the WOS or SCOPUS databases	47
BDN - Specialist works in domestic journals registered in the WOS or SCOPUS databases	24
BEC - Specialist works in foreign and domestic reviewed proceedings in world or other than world languages	0
Citations in foreign and domestic publications, registered in the WOS or SCOPUS databases' citation indexes	2
Citations in foreign and domestic publications, not registered in citation indexes	1

Source: Podklady k publikačnej činnosti, 2019

Table 4: Point assessment of other activities

Guarantor of a study program	30 p / year
Membership in international specialist and scientific associations and organizations	20 p / year / per membership
Membership in domestic specialist and scientific associations and organizations	10 p / year / per membership
Presentation of M.E,F, departments and faculty at exhibitions and public competitions abroad	15 p / year / per activity
Presentation of M.E,F, departments and faculty at domestic exhibitions and public competitions	10 p / year / a per activity
Obtaining awards abroad	20 p / per award
Obtaining domestic awards	10 p / per award
Organizing and running international scientific – conference guarantor	15 p / case
Organizing and running international scientific and specialist conferences – member of a scientific or organizational commission	10 p / case
Organizing and running domestic scientific– conference guarantor	10 b / case
Organizing and running domestic scientific and specialist conferences – member of a scientific or organizational commission	5 p / case
Membership in an editing council - international journal, journal with an international editing council	15 p / case
Membership in an editing council - domestic journal	10 p / case
Assessments and textbook reviews, projects, articles, papers– international, domestic	10 p / case

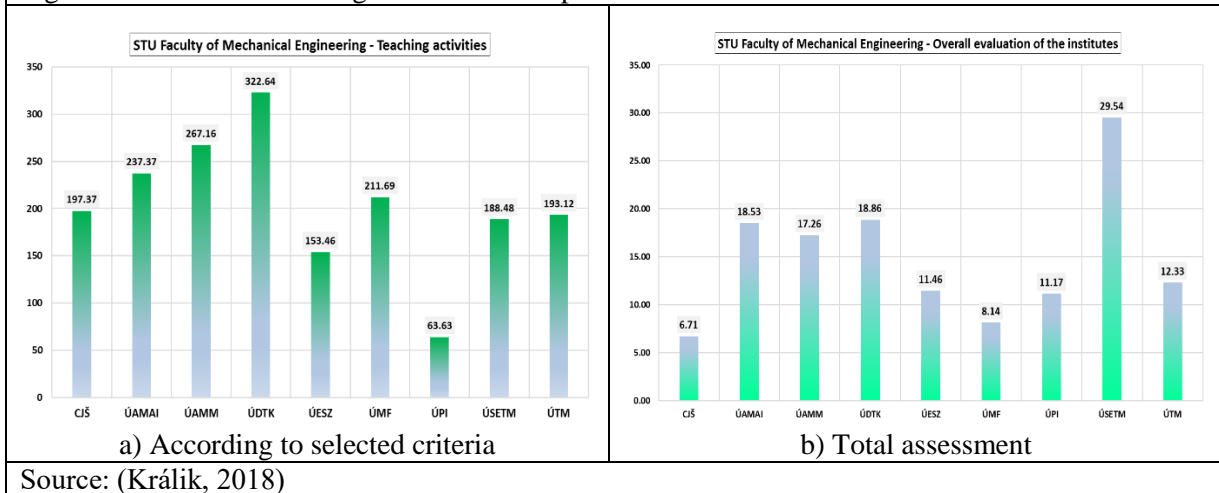
Source: Šooš, 2018

Motivation

The basic starting point for the proposal for a new system was to evaluate transparently and to positively motivate the workers in a given group.

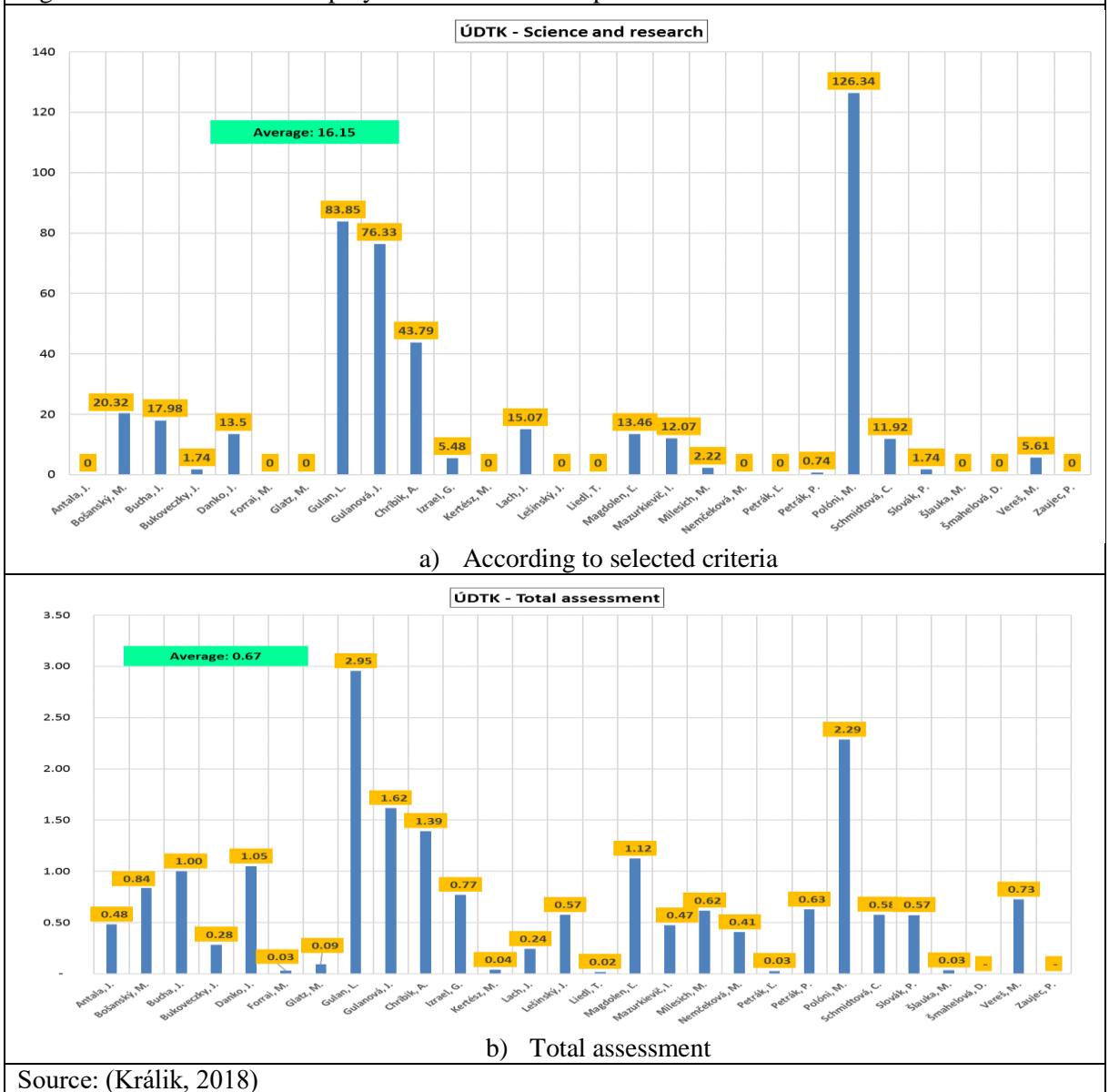
In the proposed formula (1) the values of the workers in an evaluated group are compared. By receiving a numerical value of '1' the assessed individual receives the average of the evaluated group. The basis

Figure 1: Assessment among institution workplaces



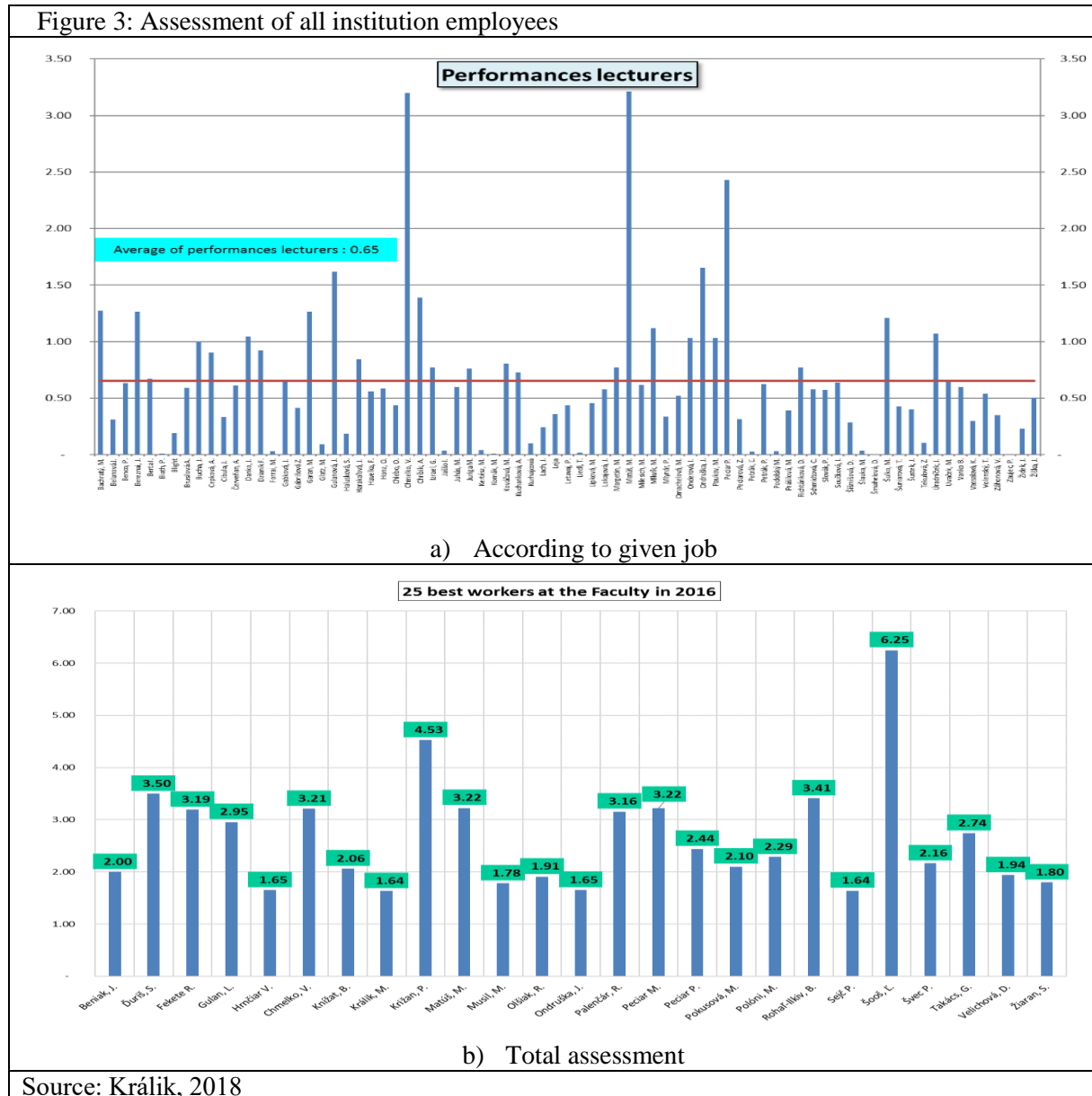
Source: (Králík, 2018)

Figure 2: Assessment of employees of selected workplace



Source: (Králík, 2018)

of the proposed system is so to motivate employees to increase their point values and to be better than the average. Employees with point assessments higher than the average are further motivated by



personal assessments. The beauty of the motivational factor lies in the fact that when several employees from a given group want to achieve better than the average, the total average of the group in the nominator increases. In this way the performance of the given group and so of the whole institution increases in the final analysis.

Universality

The system allows for the mutual comparison of the individual workplaces (fig. 1), it also allows for the comparison of the employees of a selected workplace (fig. 2), as well as of the whole group of employees of a given institution (fig. 3). We can compare people according to profession in groups of researchers or pedagogues, according to the scientific/pedagogical title achieved, or even individual employees over a period of several years, (Králik, 2018).

Autodiagnosics

The expert system also allows reverse analysis of the individual. On the basis of a simple comparison apparatus, the individual can determine where they must improve or by how much they must make up for in another area when they do not fulfill one of the other areas. A frequent question from employees

is by how much they must exceed these other areas if they do not achieve the required average in one or more categories. Accordingly, we worked out an auto-reverse mechanism into the system, (Velichova, 2018).

So how can an individual achieve an average performance when they do not fulfill a certain category? Let us assume that all employees obtain an average assessment by the head of an institute, so $t=1$ and the equation (1)

$$P_{i_emp} = x * k1 + y * k2 + z * k3 + t * k4$$

- takes the form

$$x * 0.35 + y * 0.35 + z * 0.2 = 0.9 \quad (2)$$

- if the employee does not teach, $x = 0$ and the equation (2) takes the form

$$y * 0.35 + z * 0.2 = 0.9 \quad (3)$$

- if the employee does not conduct research, $y = 0$, only publishes, then

$$z * 0.2 = 0.9 \quad \Rightarrow z = 4.5 \quad (4)$$

So their performance in publications must be 4.5 times greater than the average;

- if the employee does not publish, (then $z = 0$) and does only science, then the equation (4) takes the form

$$y * 0.35 = 0.9 \quad \Rightarrow y = 2.57 \quad (5)$$

So their performance in science must be 2.57 times greater than the average. In the case that the employee only does pedagogy and does not undertake research. Therefore, their performance in pedagogy must be 2.57 times greater than the average.

Conclusion

The goal of the prepared paper was to present an original system for the individual assessment of employees. The system is currently in operation for the second year. At the moment there are about 15,000 automatically input values in the system. The system makes possible a complex assessment of the selected employee, chosen workplace or the entire institution according to given areas, i.e. pedagogics, science and research, publications and special area. The test operation at the Faculty of Mechanical Engineering, STU BA has demonstrated its originality and transparency, as well as the opportunity to achieve the desired outputs with great variety and effectiveness.

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