THE PROPOSAL OF USING AHP METHOD FOR EVALUATION OF EMPLOYEE COMPETENCIES OF UPIM MTF STU TRNAVA

Lukáš JURÍK, Monika ŠUJAKOVÁ, Peter SAKÁL

Ing. Lukáš Jurík, Ing. Monika Šujaková, Prof. Ing. Peter Sakál, CSc.
Slovak University of Technology in Bratislava, Faculty of Materials Science and Technology in Trnava, Institute of Industrial Engineering and Management
Paulínska 16, 917 24 Trnava, Slovakia
e-mail: lukas.jurik@stuba.sk, monika.sujakova@stuba.sk, peter.sakal@stuba.sk

Abstract

A competency approach comes to the fore also in the area of teaching. Teacher status is now changing. They are creating a new model of university teacher as a professional. This model is associated with the search for identity of a teacher like highly educated expert for education and teaching. At the Institute of Industrial Engineering and Management (Faculty of Materials and Technology in Trnava, Slovak University of Technology in Bratislava), we created the Evaluation model of sustainable quality of university teacher (EMS QUT) and Evaluation model for the choice and selection of university teachers (EM SUT), which contributed to the creation of professional standards in the categories of competencies that meet the objectives of education, the function of schools and universities and activities of teachers in the real environment of educational institutions. The main aim of the article is to point at the competence assessment of the university teaching staff through competency model and method of Analytic Hierarchy Process.

Key words

competency, multi-criteria decision making, analytical hierarchy process, competency profile

INTRODUCTION

Competencies are a part of human capital that businesses can use for human development and thus growth of intellectual capital. A competency approach comes to the fore in the area of teaching activities. Teacher status is now changing. Specialists create a new model of university teacher as a professional. This model is associated with the search for identity of teacher as a highly-educated expert in education and teaching. Specialists create various professional standards in the category of competencies that meet the objectives of education, school and university functions and activities of teachers in the real environment of educational institutions. Competence development must be capable, flexible and variable. Teachers acquire and develop such competencies during their careers within the preparatory stage and lifelong learning.

At the STU MTF Institute of Industrial Engineering and Management, we have developed an assessment model of sustainable quality of university teacher and an assessment model for the selection process for filling of posts of university teachers. Competencies represent everything that employee needs to fulfil the tasks, which were assigned to him. For

the development of institutions, the employees need to develop a model regarding individual competencies. Competency models include the competencies that are necessary for achieving effective results and objectives. They are used in the development, selection, evaluation and remuneration of employees. The use of the competency approach provides conditions for application of multicriteria evaluation. The method that can be used to solve problems of this type is the analytical hierarchical process. Advantage of this approach is that it allows comprehensive evaluation of overall system of competencies and different values of weights assigned to individual competencies.

APPLICATION OF AHP METHOD FOR EVALUATION OF UPIM EMPLOYEES – *Model 1 – EMS QUT*

Competency profile of teacher is a summary of key competencies and the related capabilities, which characterize professional performance. A competency profile is the basis for further professional and career development. And it is also the basis for the system's evaluation, which relates to the motivation of teachers through evaluation and remuneration (Jurík, 2013). Application of AHP method for evaluation of competency profile of an employee of the Institute of Industrial Engineering and Management was carried out through the use of Expert Choice. The algorithm of individual steps of the analytical hierarchical process is shown in Figure 1.

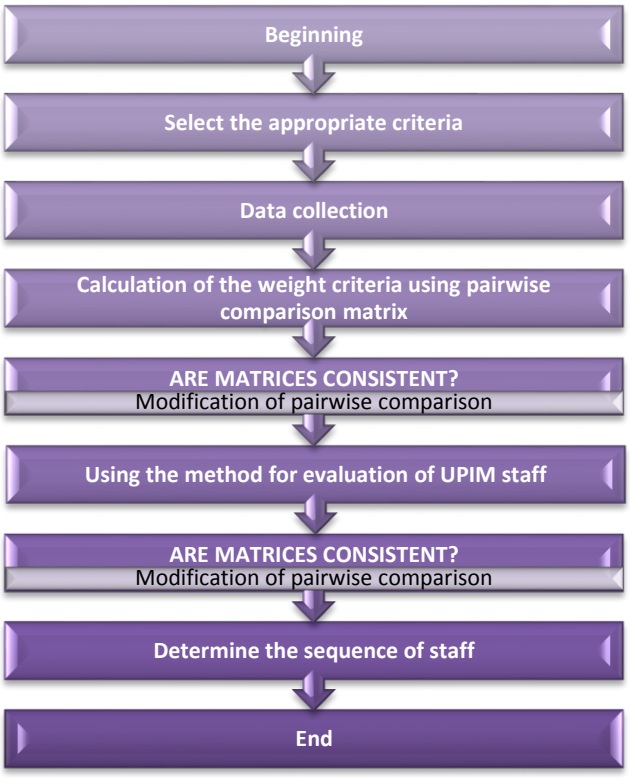

Fig. 1 *The algorithm of application of AHP method (source: drawn by the authors)*

The starting point for the application of AHP method is to create a hierarchical structure, where each element of the system is subject to one or more elements, except for the top element. The top element of the hierarchical structure represents the goal of subject.

Determination of objective decision-making

The aim was to evaluate the competency profile of an employee of Institute of Industrial Engineering and Management. This competency profile serves as the basis for future professional development of the employee, and can also serve as the basis for rewarding the employee. Objectivity of model can be seen in the selection criteria.

Alternative solutions

Alternative solutions represent the employees of Institute of Industrial Engineering and Management of Faculty of Materials Science and Technology in Trnava. The selected sample of five of the Institute employees provided their data for processing a proposal competency profile. **Y**ear 2013, or academic year 2012/2013, was elected as a starting year. This year is considered the base year, and subsequent years will provide information on the further development of individual employees.

Proposal of criteria for evaluation of alternative solutions

Proposal of criteria is another important step in developing a competency profile at the Institute of Industrial Engineering and Management. The profile consists of the main criteria, established pursuant to the profile (requirements) of employee by Prof. Ramík, as shown in Figure 2 up to Figure 6. Other criteria were chosen in consultations with the competent persons and experts in the given field - Professor Sakál and Associate Professor Chlpeková.

The other criteria were established pursuant information from:

- ***Rating agencies***
- ***Requirements of the European Parliament regarding teacher***
- ***Requirements of the Faculty of Materials Science and Technolog.***
- ***Law on Education***
- ***Other relevant resources.***

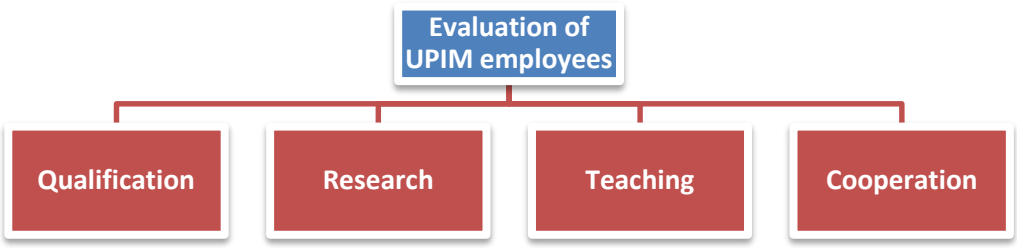

Fig. 2 *The view of the basic hierarchy (source: drawn by the authors)*

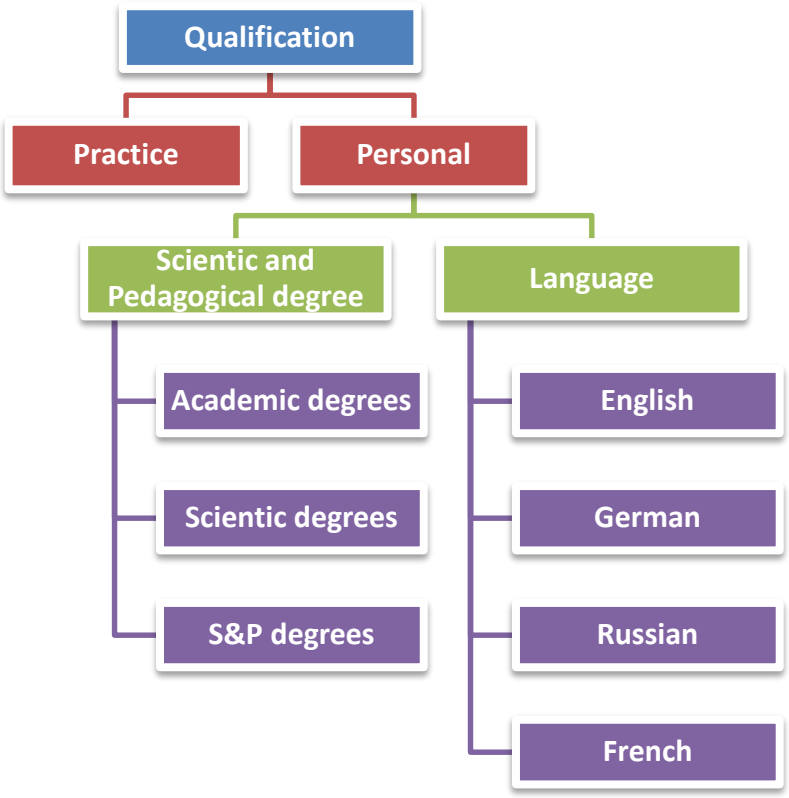

Fig. 3 *Hierarchical view criteria – Qualification (source: drawn by the authors)*

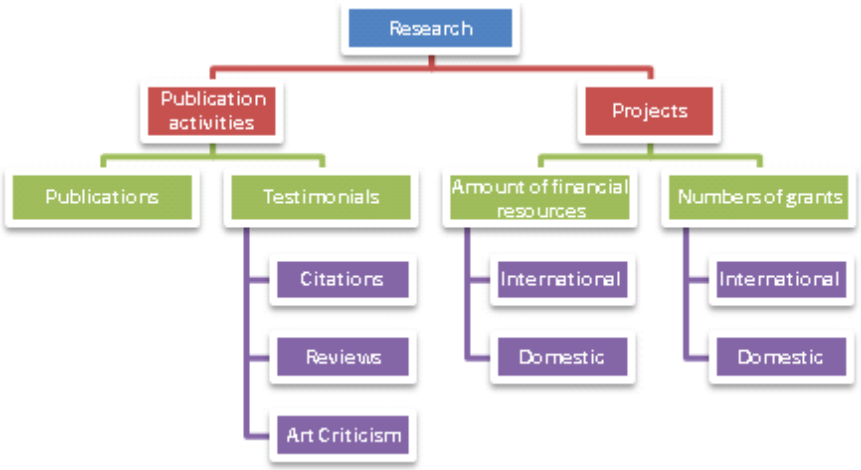

Fig. 4 *Hierarchical view criteria – Research (source: drawn by the authors)*

Fig. 5 *Hierarchical view criteria – Teaching (source: drawn by the authors)*

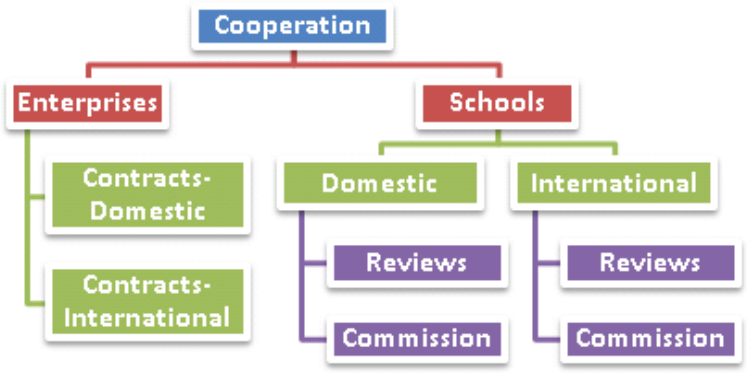

Fig. 6 *Hierarchical view criteria – Cooperation (source: drawn by the authors)*

Solving the problem through use of the Expert Choice (EC) software:

1. Determination and input of objective criteria and alternatives to the problem-solving.
2. Assigning weight to individual criterion by pairwise comparison of criteria.
3. Evaluation of alternatives by pairwise comparisons of individual criteria.
4. Evaluation of the optimal alternative solution.

Determine the weights of criteria

After the establishment of the hierarchical structure, we had to assign a weight to each criterion. Weights of individual criteria are calculated by Expert Choice. The calculation was performed by means of comparison of matrix criteria. The values in the comparison matrix were determined based on the questionnaire evaluation, which was circulated among the experts in the field, and based on the adjustment of the matrix consistency. Matrix of pairwise comparison is based on the principle of mutual comparison of matrix for two elements, which is appropriate to the value of the scale from 1 to 9. In Figure 7, we can see that the most important criterion of the first-level hierarchical structure is the criterion of Cooperation, and the criterion of Qualification has the lowest weight. Any such comparison in Expert Choice program contains value consistency, which may not exceed 0.1. In this case, the value of consistencies is 0.03, which means that the matrix is consistent.

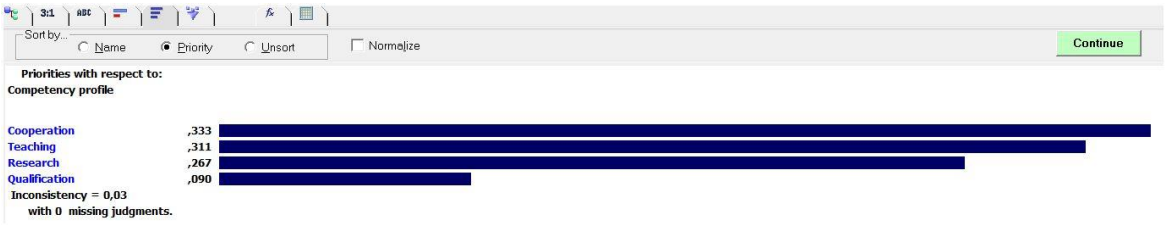

Fig. 7 *Analysis of consistency and assessing the significance criteria (source: EC program)*

Evaluation of alternatives

Evaluation of alternatives can be performed by using the pairwise comparisons. When we did evaluation of alternatives for individual criteria, comparison matrices were always consistent. If the consistency exceeded the value of 0.1, the values in the matrix were then adjusted, not to exceed the limit of consistency. In the tables below, the employees of STU MTF UPIM are named as P1, P2, P3, P4 and P5.

Figure 8 shows the ranking of employees. The most competent employee is employee P1, followed by employees P2, P5, P3 and employee P4 on last position. Consistency of the matrix overall assessment reached 0.04, which implies that the consistency condition has been satisfied.

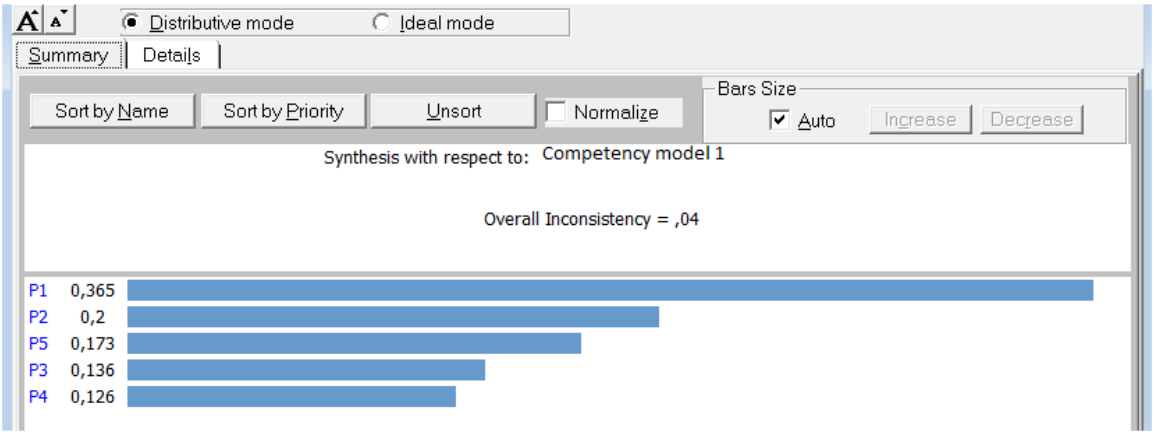

Fig. 8 *Result of the variants evaluation (source: program EC)*

Result of the alternatives evaluation

The resulting values of compared employees for the individual criteria are shown in Figure 8. Employees are named as P1, P2, P3, P4, and P5. For each criterion, also weight of criteria is shown. Weight of criteria determines how the criterion involved in the overall assessment of the employee. At first glance, it is obvious from the Figure that the employee P1 is situated on the first position with regard to other employees.

APPLICATION OF AHP METHOD FOR EVALUATION OF COMPETENCY PROFILE OF UPIM TEACHERS – *Model 2 - EMSUT*

Another model was designed based on the recommendations from the Faculty Personnel Office. It is a competency model for the assessment of candidates for a job position as a university teacher. The starting point for the application of AHP method is also creating a hierarchical structure.

Determination of objective decision-making

The objective of decision-making was to determine selection of the most suitable candidate for the job position of a university teacher, and to create Model 2, as the proposal of competency profile of candidate for job position of teacher of the Institute Industrial Engineering and Management.

Alternative solutions

Alternative solutions are presented by employees of the STU MTF Institute of Industrial Engineering and Management in Trnava. Employees were contacted through a questionnaire. We selected a sample of 6 random respondents.

Proposal of criteria for evaluation of alternative solutions

The following 12 key criteria to be met by the candidate for the UPIM teacher position were selected for the Model 2:

- ***Knowledge of a foreign language;***
- ***Tolerance*** *(multicultural thinking);*

- ***Ability to lead people;***
- ***Ability to motivate people;***
- ***Empathy;***
- ***Critical thinking;***
- ***Ability of self-control;***
- ***Personality and natural intelligence;***
- ***Diligence;***
- ***Responsibility;***
- ***Knowledge of the subject taught;***
- ***Communication and rhetorical skills;***

Determining the weight of criteria

The calculation was performed by means of the comparison matrix criteria. These values in the comparison matrix were determined based on the evaluation of the questionnaire that was circulated among the experts in the field, and the following adjustment of the matrix consistency.

Figure 9 shows that the most important criterion is Responsibility and criterion Knowledge of foreign language has the least weight. The value of consistency is 0.06, which means that the matrix is consistent and we can precede pairwise comparisons of individual variants.

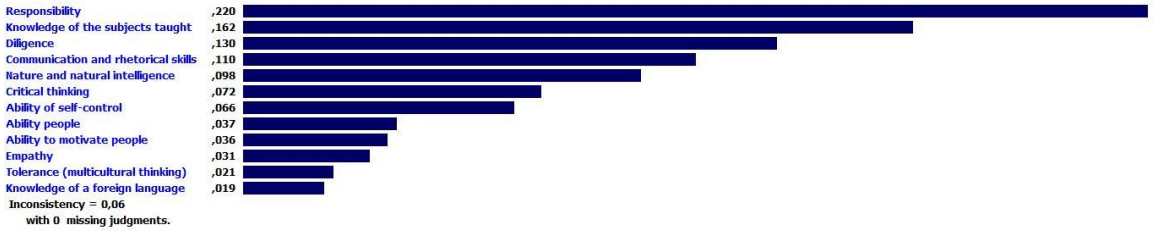

Fig. 9 *Analysis of consistency and assessing the significance criteria (source: program EC)*

Evaluation of alternatives

Evaluation of alternatives can be performed by using the pairwise comparisons. When we made evaluation of alternatives for individual criteria, comparison matrices were always consistent. If the consistency exceeded a value of 0.1, the values in the matrix were then adjusted not to exceed the limit of consistency. Figure 10 shows the ranking of employees.

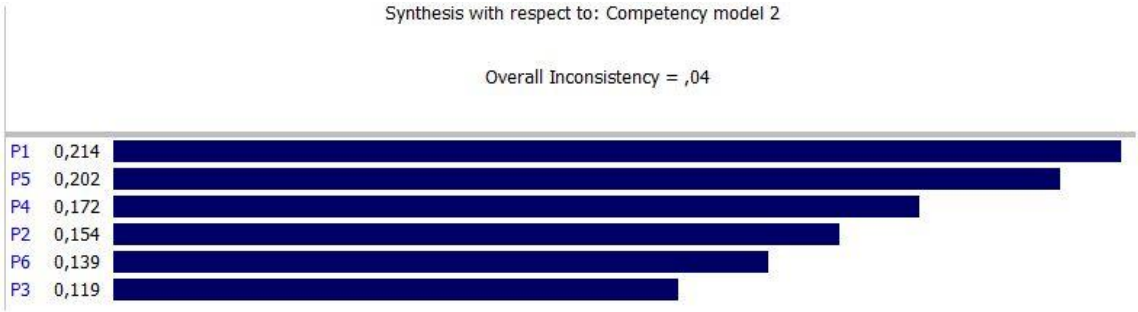

Fig. 10 *Result of the variants evaluation (source: program EC)*

Result of the variants evaluation

For each criterion, the weight of criteria is also shown. Weight of criteria determines how the criterion ranks in the overall assessment of the employee. As respondents indicated, P1 is on the first position, followed by the respondent labelled P5; respondent P3 takes the last position.

CONCLUSION

Competency approach in the area of education is important for future development. By using the competency approach, we can objectively evaluate and reward employees. To meet the required performance of the job, it is appropriate to develop a competency profile of teaching employees that includes their skills, knowledge, character traits and attitudes. Basis for the multi-criteria decision-making method is a multi-criteria nature of the problems in education. The method that is most commonly used to solve problems of this type is the analytical hierarchical process. Its advantage is that it allows you to evaluate the overall system competence and assigns different value of weights to individual competencies. On the basis of the knowledge, two competency models that are applicable to such assessment were developed.

Acknowledgement

The paper builds on the results of APVV project No. LPP-0384-09 ,,Koncept HCS modelu 3E vs. koncept Corporate Social Responsibility (CSR)'' and KEGA project No. 037STU-4/2012 Implementation of the subject of "Sustainable Corporate Social Responsibility" into the study programme of Industrial Management in the second degree of study at STU MTF Trnava.

The paper is a part of VEGA project No. 1/0448/13 "Transformation of ergonomics program into the company management structure through integration and utilization and of QMS, EMS, HSMS".

References:

1. ŠUJAKOVÁ, M. 2014. *Návrh využitia metódy AHP pre určenie kompetenčného profilu pracovníka UPIM MTF STU Trnava (The proposal of using AHP method to determine the worker competency profile of STU MTF UPIM Trnava).* Master thesis. STU MTF Trnava.
2. BAĎO,R., VRABLIC P. *Využitie metódy multikriteriálneho rozhodovania metódou AHP pri rozhodovaní v podnikateľskom prostredí.* (*Using methods of multi-criteria decision making method AHP in decision-making in the business environment.).* http://www.sjf.tuke.sk/transferinovacii/pages/archiv/transfer/21-2011/pdf/082-085.pdf
3. *Expert Choice – stručný manual (brief manual).* http://homepages.math.slu.cz/BarboraKalicinska/EC_manual.pdf
4. JURÍK, L. 2013. *Návrh využitia metódy AHP pre určenie kompetenčného profilu personálneho pracovníka podniku Delta Electronics (Slovakia), s.r.o. (The proposal of using AHP method for determination of recruiter's competency profile of Delta Electronics (Slovakia), s.r.o.) Company.* Master thesis. STU MTF Trnava.
5. KASÁČOVÁ, B. et al. 2006. *Profesijný rozvoj učiteľa*. (Professional development of teachers.). Prešov: Rokus. ISBN 80-8045-431-0.

6. KELLER, Jan. 2011. *Nová sociální rizika. (New social risks.).* Praha: Kamýk. ISBN 978-80-7419-059-9.
7. *Personálna politika MTF so sídlom v Trnave*. (*Personnel policy of MTF in Trnava.)* http://www.mtf.stuba.sk/docs//doc/Informacie_o/Personalna_politika_MTF_final.pdf
8. Kompetencie a znalosti učiteľa technických vzdelávacích predmetov: Učebnica didaktiky technickej výchovy. (Competencies and knowledge of teacher of technical subjects: Textbook of didactics of technical education.). 2011 http://ki.ku.sk/cms/utv/34_3.2-Kompetencie-a-znalosti-ucitela-technickych-vzdelavacich-predmetov
9. RAMÍK, J. 2010. Analytický hierarchický proces (AHP) a jeho možnosti uplatnenia pri hodnotení a podpore rozhodovania. (Analytic Hierarchy Process (AHP) and its potential application in the assessment and support of decision). In *Matematika v ekomonické praxi*. Jihlava: Vysoká škola polytechnická. ISBN 978-80-87035-34-4.

Reviewers:

Prof. Ing. Anna Zaušková, PhD.
doc. Ing. Andrea Chlpeková, PhD.