International Journal of Vocational and Technical Education Vol.1 (1), pp. 007-013, July, 2009
Available online at http://www.academicjournals.org/IJVTE

Full Length Research Paper

Use of compromise ranking method for supervisor selection: A multi-criteria decision making (MCDM) approach

S. Datta[1]*, G. S. Beriha[1], B. Patnaik[2] and S. S. Mahapatra[1]

[1]Department of Mechanical Engineering, National Institute of Technology, Rourkela, Orissa-769008, India.
[2]Department of Humanities and Social Sciences, National Institute of Technology, Rourkela, Orissa-769008, India.

Accepted 21 April, 2009

In the present reporting a strategic methodology adapted from multi-criteria-decision making (MCDM) has been proposed to select a suitable research guide. There are several criteria that influence the efficacy of a quality researcher while guiding his/her scholar towards a positive and effective research outcome. Often scholars are asked to give their preference or to opt for a supervisor under whom he/she wishes to work in future. In this situation, the students may face some problem in selection of the appropriate guide because there is no specific guideline on the said selection procedure. It is felt that research is nothing but an academic association and the extent of cooperation as well as interaction from both end are to be the key factors for achieving good research output. It is nothing but a mutual knowledge sharing process between supervisor and the scholar. Sometimes improper selection may cause depression as well as de-motivation of the research scholar. To solve this problem, the present study highlights evaluating means by which quality and acceptability of a supervisor can be estimated quantitatively which would be helpful to select the best one prior to starting research career under the guidance of a supervisor. In this paper a study has been made by applying COPRAS-G method for quality evaluation of a supervisor. Application feasibility as well as efficiency of this method and guidelines in solving such a multi-attribute decision making problem in supervisor selection has been described illustratively in this paper.

Key words: Multi-criteria-decision making (MCDM), COPRAS-G method.

INTRODUCTION

Literature depicts that work has been explored on various aspects of quality evaluation and performance appraisal in various service sectors: education, healthcare, hospitality, tourism, private or public sector as well. However, it should be noted that service quality differs from product quality. Product quality can be estimated by some quantitative attributes which can be measured and the extent of quality of the product can be estimated. While in case of evaluating quality of a service sector as a whole or evaluating quality of an individual, most of the attributes become qualitative. As for example the quality of a tea teacher depends on his teaching strategy, teaching methodology, extent of knowledge, student interaction and many others. These attributes cannot be estimated quantitatively. Even there is no clear-cut indication on which criteria is the most important to be examined first or which criteria imposes negligible influence on evaluating a teacher's quality. Therefore, survey data is generally required to pull out opinions collected from different personnel. Based on some multi-criteria decision making methodologies, these survey data are analyzed to estimate the relative priority weights of the said criterion. Previous researchers have proposed different statistics based multi-criteria decision making techniques to address this issue. I-Huei Ho et al. (2001) investigated the management and performance of engineering educational systems. The concept of balanced scorecard was explored to construct a performance evaluation model. Ana Lúcia Miranda Lopes and Edgar Augusto Lanzer (2002) addressed the issue of performance evaluation-productivity and quality of academic departments at a

*Corresponding author. E-mail: sdattaju@gmail.com, gouri_1979@yahoo.co.in, pbhaswati03@yahoo.co.in, mahapatrass2003@yahoo.com

University. Data Envelopment Analysis (DEA) was applied to simulate a process of cross evaluation between the departments.

Emilio Martin (2003) applied DEA methodology for assessing the performance of Zaragoza University's departments (Spain). Hahn-Ming Lee et al. (2005) reported a novel personalized recommendation system with online preference analysis in a distance learning environment called *Coursebot*. Users can both browse and search for course materials by using the interface of *Coursebot*. Moreover, the proposed system included appropriate course materials ranked according to a user's interests. In this work, an analysis measure was proposed to combine typical grey relational analysis and implicit rating. In this way a user's interests were estimated from the content of documents and the user's browsing behavior. This algorithm's low computational complexity and ease of adding knowledge supported online personalized analysis. In addition, the user profiles were dynamically revised to provide efficiency personalized information that reflects a user's interests after each page is visited. Kosmas Kotivas et al. (2005) presented a self evaluation methodology on a specific post graduate engineering course in the critical technological area of advanced materials. The methodology developed was based on total quality management (TQM) procedures that were introduced in the higher education sector in Greece. P. Kousalya et al. (2006) applied Analytical Hierarchy Process (AHP) to a decision making problem related to an educational arena. Through survey on the expert options, the criteria that cause student absenteeism were identified and the criteria hierarchy was developed. The relative importance of those criteria for Indian environment was obtained through the opinion survey. Cai Longhorn and Lin Chongde (2006) suggested that teacher performance evaluation should find its theoretical foundation in teacher performance constructs. After making literature review, critical case study, critical interview and qualitative research, the authors proposed a new conceptual construct of teacher performance and made necessary analysis for the construct of reliability and validity in empirical approaches. S. S. Mahapatra and M. S. Khan (2007) developed a quality measuring instrument called EduQUAL and proposed a Neural Network (NN) based integrated approach for evaluating service quality in education sector.

Mary Caroline N. Castano and Emilyn Cabanda (2007) evaluated the efficiency and productivity growth of state universities and colleges (SUCs) in the Philippines. The SUCs performance was determined on the changes in total factor productivity (TFP), technological and technical efficiency. Data Envelopment Analysis (DEA) has been adopted in estimating the relative performance of SUCs. Wan Salmuni Wan Mustaffa and Hariri Kamis (2007) applied Analytic Hierarchy Process (AHP) technique to develop a staff performance appraisal system in the scenario of higher education system in Malaysia. Nina Begičević, Blaženka Divjak and Tihomir Hunjak (2007) performed factor analysis on the survey data and constructed AHP based model for decision making on e-learning implementation. Organizational readiness, that includes university framework and faculty strategy for development, as well as financial readiness, was recognized as the most influential for e-learning implementtation. It was found as a weakness of most Croatian universities and faculties, since the strategic planning of university and faculty development has been systematically neglecting. Mónica García Melón et al. (2008) proposed a procedure to evaluate proposals for educational innovation projects. It was reported that the proposed methodology should help the institute of educational sciences of the Polytechnic University of Valencia to choose the best Educational Project. It was aimed to provide the administration with a stringent evaluation methodology. Based on AHP the paper has been focused on the weight assignment of the different criteria chosen by the experts. Literature depicts that much work has been explored on various aspects of educational quality as well as performance evaluation. Criteria selection of evaluating quality of an individual has also been addressed too. But search is still being continued which indicates that more in-depth study, more efficient tools are to be developed and adopted in order to understand this type of behavioral science. In consideration of the above, the present study highlights a multi-criteria decision making (MCDM) approach to be applied for overall quality evaluation which is necessary prior to selection of a thesis supervisor.

A survey of junior and senior research scholars was conducted to obtain a preference list of criteria that are found to be significant for selection of a research guide. Overall quality and performance of a supervisor has been computed by applying COPRAS-G method [Edmundas Zavadskas et al. (2007); Edmundas Kazimieras Zavadskas et al. (2008); Nerija Banaitiene et al. (2008)] adapted from grey relational analyses. The paper illustrates detailed methodology of the aforesaid approach and highlights its effectiveness.

COPRAS-G method

In order to evaluate the overall efficiency of a project, it is necessary to identify selection criteria, to assess information, relating to these criteria, and to develop methods for evaluating the criteria to meet the participants' needs. Decision analysis is concerned with the situation in which a decision maker has to choose among several alternatives by considering a particular set of criteria. For this reason COPRAS method can be applied [Edmundas Kazimieras Zavadskas et al. (2008)].
The idea of COPRAS-G method with the criterion values expressed in terms of intervals is based on the real conditions of decision making and applications of the grey system theory.

The COPRAS-G method uses a stepwise ranking and evaluating procedure of the alternatives in terms of significance and utility degree.

The procedure of applying the COPRAS-G method consists of the following steps.

1. Selecting the set of the most important criteria, describing the alternatives.
2. Constructing the decision-making matrix $\otimes X$:

$$\otimes X = \begin{bmatrix} [\otimes x_{11}] & \ldots\ldots & \ldots\ldots & [\otimes x_{1m}] \\ [\otimes x_{21}] & \ldots\ldots & \ldots\ldots & [\otimes x_{2m}] \\ . & & & \\ . & \ldots\ldots & \ldots\ldots & \ldots\ldots \\ . & & & \\ [\otimes x_{n1}] & \ldots\ldots & \ldots\ldots & [\otimes x_{nm}] \end{bmatrix} =$$

$$\begin{bmatrix} [\underline{x}_{11}; \overline{x}_{11}] & [\underline{x}_{12}; \overline{x}_{12}] & \ldots\ldots & [\underline{x}_{1m}; \overline{x}_{1m}] \\ [\underline{x}_{21}; \overline{x}_{21}] & [\underline{x}_{22}; \overline{x}_{22}] & \ldots\ldots & [\underline{x}_{2m}; \overline{x}_{2m}] \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ [\underline{x}_{n1}; \overline{x}_{n1}] & [\underline{x}_{n2}; \overline{x}_{n2}] & \ldots\ldots & [\underline{x}_{nm}; \overline{x}_{nm}] \end{bmatrix}; j = \overline{1,n}; \overline{1,m} \quad (1)$$

Here $\otimes x_{ji}$ is determined by $\underline{x}_{ji}$ (the smallest value, the lower limit) and $\overline{x}_{ji}$ (the biggest value, the upper limit).

3. Determining significances of the criteria q_i.
4. Normalizing the decision-making matrix $\otimes X$:

$$\underline{\tilde{x}}_{ji} = \frac{\underline{x}_{ji}}{\frac{1}{2}\left(\sum_{j=1}^{n} \underline{x}_{ji} + \sum_{j=1}^{n} \overline{x}_{ji}\right)} = \frac{2\underline{x}_{ji}}{\left(\sum_{j=1}^{n} \underline{x}_{ji} + \sum_{j=1}^{n} \overline{x}_{ji}\right)}$$

$$\overline{\tilde{x}}_{ji} = \frac{\overline{x}_{ji}}{\frac{1}{2}\left(\sum_{j=1}^{n} \underline{x}_{ji} + \sum_{j=1}^{n} \overline{x}_{ji}\right)} = \frac{2\overline{x}_{ji}}{\sum_{j=1}^{n}\left(\underline{x}_{ji} + \overline{x}_{ji}\right)}; j = \overline{1,n}; \overline{1,m}$$

(2)

In formula (2) $\underline{x}_{ji}$ is the lower value of the i criterion in the alternative j of the solution; $\overline{x}_{ji}$ is the upper value of the criterion i in the alternative j of the solution; m is the number of criteria; n is the number of the alternatives, compared.

Then, the decision-making matrix is normalized:

$$\otimes \tilde{X} = \begin{bmatrix} [\underline{\tilde{x}}_{11}, \overline{\tilde{x}}_{11}] & [\underline{\tilde{x}}_{12}, \overline{\tilde{x}}_{12}] & \ldots\ldots & [\underline{\tilde{x}}_{1m}, \overline{\tilde{x}}_{1m}] \\ [\underline{\tilde{x}}_{21}, \overline{\tilde{x}}_{21}] & [\underline{\tilde{x}}_{22}, \overline{\tilde{x}}_{22}] & \ldots\ldots & [\underline{\tilde{x}}_{2m}, \overline{\tilde{x}}_{2m}] \\ . & . & & . \\ . & . & \ldots\ldots & . \\ . & . & & . \\ . & . & & . \\ [\underline{\tilde{x}}_{n1}, \overline{\tilde{x}}_{n1}] & [\underline{\tilde{x}}_{n2}, \overline{\tilde{x}}_{n2}] & \ldots\ldots & [\underline{\tilde{x}}_{nm}, \overline{\tilde{x}}_{nm}] \end{bmatrix} \quad (3)$$

5. Calculating the weighted normalized decision matrix $\otimes \hat{X}$. The weighted normalized values $\otimes \hat{x}_{ji}$ are calculated as follows:

$$\otimes \hat{x}_{ji} = \otimes \tilde{x}_{ji}.q_i \text{ or } \underline{\hat{x}}_{ji} = \underline{\tilde{x}}_{ji}.q_i \text{ and } \overline{\hat{x}}_{ji} = \overline{\tilde{x}}_{ji}.q_i \quad (4)$$

In formula (4), q_i is the significance of the $i-th$ criterion.

$$\otimes \hat{X} = \begin{bmatrix} [\otimes \hat{x}_{11}] & [\otimes \hat{x}_{12}] & \ldots\ldots & [\otimes \hat{x}_{1m}] \\ [\otimes \hat{x}_{21}] & [\otimes \hat{x}_{22}] & \ldots\ldots & [\otimes \hat{x}_{2m}] \\ \vdots & \vdots & \ldots\ldots & \vdots \\ [\otimes \hat{x}_{n1}] & [\otimes \hat{x}_{n2}] & \ldots\ldots & [\otimes \hat{x}_{nm}] \end{bmatrix} = \begin{bmatrix} [\underline{\hat{x}}_{11}, \bar{\hat{x}}_{11}] & [\underline{\hat{x}}_{12}, \bar{\hat{x}}_{12}] & \ldots\ldots & [\underline{\hat{x}}_{1m}, \bar{\hat{x}}_{1m}] \\ [\underline{\hat{x}}_{21}, \bar{\hat{x}}_{21}] & [\underline{\hat{x}}_{22}, \bar{\hat{x}}_{22}] & \ldots\ldots & [\underline{\hat{x}}_{2m}, \bar{\hat{x}}_{2m}] \\ \vdots & \vdots & \ldots\ldots & \vdots \\ [\underline{\hat{x}}_{n1}, \bar{\hat{x}}_{n1}] & [\underline{\hat{x}}_{n2}, \bar{\hat{x}}_{n2}] & \ldots\ldots & [\underline{\hat{x}}_{n2}, \bar{\hat{x}}_{n2}] \end{bmatrix} \quad (5)$$

Now, the normalized decision-making matrix is of the form:

6. Calculating the sums P_j of the criterion values whose larger values are more preferable by the formula given below:

$$P_j = \frac{1}{2}\sum_{i=1}^{k}\left(\underline{\hat{x}}_{ji} + \bar{\hat{x}}_{ji}\right) \quad (6)$$

7. Calculating the sums R_j of the criterion values whose smaller values are more preferable by the formula:

$$R_j = \frac{1}{2}\sum_{i=k+1}^{m}\left(\underline{\hat{x}}_{ji} + \bar{\hat{x}}_{ji}\right); i = \overline{k,m} \quad (7)$$

In formula (7), $(m-k)$ is the number of criteria which must be minimized.

8. Determining the minimal value of R_j as follows:

$$R_{\min} = \min_j R_j; \quad j = \overline{1,n} \quad (8)$$

9. Calculating the relative significance of each alternatively Q_j the expression:

$$Q_j = P_j + \frac{\sum_{j=1}^{n} R_j}{R_j \cdot \sum_{j=1}^{n} \frac{1}{R_j}} \quad (9)$$

10. Determining the optimally criterion by K the formula:

$$K = \max_j Q_j; \quad j = \overline{1,n} \quad (10)$$

11. Determining the priority order of the alternatives.
12. Calculating the utility degree of each alternative by the formula:

$$N_j = \frac{Q_j}{Q_{\max}} \times 100\% \quad (11)$$

Here Q_j and $Q_{\max}$ are the significances of the alternatives obtained from equation (9).

Criteria selection and data survey

In order to show the application feasibility of COPRAS-G method, in the present study an example on quality evaluation for selection of a thesis supervisor has been considered. Survey data collected from scholar community for estimation of quality as well as performance of individual research guides. The following factors have been selected for survey and assumed to influence quality level as well as acceptability of a supervisor. These are as indicated in Table 1.

Respondents have been directed to rate each statement using *interval marking*. Sixteen key indicators $\otimes x_i$ were identified for supervisor selection. Optimization directions of the selected criteria are as follows:

$$\otimes x_{1,2,3,4,5,6,7,8,9,10,11,12,14,15} \overrightarrow{Optimal\,direction}(Max)$$

$$\otimes x_{13,16} \overrightarrow{Optimal\,direction}(Min)$$

Selection of the best supervisor

Respondents' opinions have been represented in Table 2 (Appendix). It indicates initial decision making matrix $\otimes X$ with the criterion values described in intervals. It has been assumed that all criteria (presented in Table 1) are equally important in judging quality levels of individual supervisors. Therefore, an equal weight age value of

Table 1. Criteria for selection of a thesis supervisor.

Sl. No.	Criteria
C01 $(\otimes x_1)$	Past record on research guidance
C02 $(\otimes x_2)$	Research publications
C03 $(\otimes x_3)$	Projects and consultancy
C04 $(\otimes x_4)$	Pedagogy of teaching
C05 $(\otimes x_5)$	Friendly interaction with students
C06 $(\otimes x_6)$	Reputation among the students whom previously guided
C07 $(\otimes x_7)$	Reputation among colleagues in the department
C08 $(\otimes x_8)$	Problem solving capacity
C09 $(\otimes x_9)$	Knowledge in computer programming language
C10 $(\otimes x_{10})$	Depth of knowledge in his/her own field
C11 $(\otimes x_{11})$	Contacts in academic fraternity
C12 $(\otimes x_{12})$	Administrative position at the institute
C13 $(\otimes x_{13})$	Extent of academic exploitation
C14 $(\otimes x_{14})$	Communication skill
C15 $(\otimes x_{15})$	Dedication (Punctuality, involvement, extent to work hard)
C16 $(\otimes x_{16})$	Attitude like a "boss"

0.0625 has been assigned to all criteria (quality estimates). The initial decision making matrix $\otimes X$ has been normalized first as discussed in section 2.

The normalized decision making matrix $\otimes \hat{X}$ is presented in Table 3 (Appendix). As per the presentation mode, for example (Supervisor 1) using equations (6) to (11). These are furnished in Table 4. Based on the results of Table 4, it is advised that the supervisor who corresponds to the highest utility degree should be selected.

According to N, the ranks obtained in the procedure of supervisor selection are as follows:

$$Supervisor\,3 > Supervisor\,1 > Supervisor\,2 .$$

Based on the results of this ranking, the third supervisor was selected.

Table 2. Initial decision making matrix with the criterion values described in intervals $\otimes X$.

	$\otimes x_1$	$\otimes x_2$	$\otimes x_3$	$\otimes x_4$	$\otimes x_5$	$\otimes x_6$	$\otimes x_7$	$\otimes x_8$	$\otimes x_9$	$\otimes x_{10}$	$\otimes x_{11}$	$\otimes x_{12}$	$\otimes x_{13}$	$\otimes x_{14}$	$\otimes x_{15}$	$\otimes x_{16}$
Opt.	max	max	max	max	max	max	max	max	max	max	max	max	min	max	max	min
q_i	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625
Supervisor	$\otimes x_1$	$\otimes x_2$	$\otimes x_3$	$\otimes x_4$	$\otimes x_5$	$\otimes x_6$	$\otimes x_7$	$\otimes x_8$	$\otimes x_9$	$\otimes x_{10}$	$\otimes x_{11}$	$\otimes x_{12}$	$\otimes x_{13}$	$\otimes x_{14}$	$\otimes x_{15}$	$\otimes x_{16}$
	$\underline{x}_1, \overline{x}_1$	$\underline{x}_2, \overline{x}_2$	$\underline{x}_3, \overline{x}_3$	$\underline{x}_4, \overline{x}_4$	$\underline{x}_5, \overline{x}_5$	$\underline{x}_6, \overline{x}_6$	$\underline{x}_7, \overline{x}_7$	$\underline{x}_8, \overline{x}_8$	$\underline{x}_9, \overline{x}_9$	$\underline{x}_{10}, \overline{x}_{10}$	$\underline{x}_{11}, \overline{x}_{11}$	$\underline{x}_{12}, \overline{x}_{12}$	$\underline{x}_{13}, \overline{x}_{13}$	$\underline{x}_{14}, \overline{x}_{14}$	$\underline{x}_{15}, \overline{x}_{15}$	$\underline{x}_{16}, \overline{x}_{16}$
S1	40, 60	40, 60	20, 30	90, 95	90, 95	60, 70	80, 90	60, 70	20, 30	80, 90	80, 90	40, 60	20, 30	80, 90	60, 70	20, 30
S2	90, 95	60, 70	40, 60	60, 70	40, 60	40, 60	40, 60	80, 90	80, 90	90, 95	60, 70	40, 60	60, 70	80, 90	90, 95	40, 60
S3	90, 95	90, 95	80, 90	80, 90	90, 95	90, 95	90, 95	90, 95	90, 95	90, 95	80, 90	80, 90	80, 90	90, 95	90, 95	40, 60

Table 3. Normalized weighted matrix $\otimes \hat{X}$.

Supervisor	$\underline{\hat{x}}_1, \overline{\hat{x}}_1$	$\underline{\hat{x}}_2, \overline{\hat{x}}_2$	$\underline{\hat{x}}_3, \overline{\hat{x}}_3$	$\underline{\hat{x}}_4, \overline{\hat{x}}_4$	$\underline{\hat{x}}_5, \overline{\hat{x}}_5$	$\underline{\hat{x}}_6, \overline{\hat{x}}_6$	$\underline{\hat{x}}_7, \overline{\hat{x}}_7$	$\underline{\hat{x}}_8, \overline{\hat{x}}_8$	$\underline{\hat{x}}_9, \overline{\hat{x}}_9$	$\underline{\hat{x}}_{10}, \overline{\hat{x}}_{10}$	$\underline{\hat{x}}_{11}, \overline{\hat{x}}_{11}$	$\underline{\hat{x}}_{12}, \overline{\hat{x}}_{12}$	$\underline{\hat{x}}_{13}, \overline{\hat{x}}_{13}$	$\underline{\hat{x}}_{14}, \overline{\hat{x}}_{14}$	$\underline{\hat{x}}_{15}, \overline{\hat{x}}_{15}$	$\underline{\hat{x}}_{16}, \overline{\hat{x}}_{16}$
S1	0.011	0.012	0.008	0.023	0.024	0.018	0.022	0.015	0.006	0.019	0.021	0.014	0.007	0.019	0.015	0.010
	0.016	0.018	0.012	0.024	0.025	0.021	0.025	0.018	0.009	0.021	0.024	0.020	0.011	0.021	0.018	0.015
S2	0.024	0.018	0.016	0.015	0.011	0.012	0.011	0.021	0.025	0.021	0.016	0.014	0.021	0.019	0.023	0.020
	0.025	0.021	0.023	0.018	0.016	0.018	0.016	0.023	0.028	0.022	0.019	0.027	0.025	0.021	0.024	0.030
S3	0.024	0.027	0.031	0.021	0.024	0.027	0.025	0.023	0.028	0.021	0.021	0.027	0.029	0.021	0.023	0.020
	0.025	0.029	0.035	0.023	0.025	0.029	0.026	0.024	0.029	0.022	0.024	0.030	0.032	0.023	0.024	0.030

Table 4. On evaluation of utility degree.

Supervisor	P_j	R_j	Q_j	N_j
S1	0.2495	0.0215	0.3176	72.58%
S2	0.2735	0.0480	0.3040	69.47%
S3	0.3540	0.0555	0.4376	100%

Conclusion

Supervisor selection is a multi-criteria decision making problem. In actual multi-criteria modeling of multi-alternative assessment problems, the criteria values can be expressed in terms of intervals.

COPRAS-G (a COPRAS method with grey criteria values) is a method for assessing the alternatives by multiple criteria values expressed in terms of intervals. This approach is intended to support decision making and to increase the efficiency of the resolution process.

The method COPRAS-G may be applied to solving a wide range of problems associated with MCDM.

REFERENCES

I-Huei Ho, Tzai-Fu Cheng, Chieh-Yu Lin (2001). "The Construction of the Performance Evaluation Model for Engineering Education *Systems*", Intl. Conf. Eng. Edu. Aug. 6-10, Oslo, Norway.

Ana LML, Edgar AL (2002). "Data Envelopment Analysis-DEA and Fuzzy Sets to Assess the Performance of an Academic Departments: A Case Study at a Federal University of Santa Catarina-UFSC", Pesquisa Operacional, 22(2): 217-230.

Emilio M (2003). "An Application of the Data Envelopment Analysis Methodology in the Performance Assessment of the Zaragoza University Departments", Documento de Trabajo 2003-06.

Hahn-Ming L, Chi-Chun H, Tzu-Ting K (2005), "*Personalized* Course Navigation Based on Grey Relational Analysis", Applied Intelligence, 22: 83-92.

Kosmas K, Tsipa M L, Tsipas D N (2005). "The Development and Implementation of a Pilot Internal Evaluation. Procedure for Postgraduate Engineering Courses", World Trans. Eng. Tech. Edu. 4(1): 83-86.

Kousalya P, Ravindranath V, Vizayakumar K (2006). "Student Absenteeism in Engineering Colleges: Evaluation of Alternatives Using AHP", J. App. Math. Dec. Sci. Vol 2006, Article ID 58232, pp. 1-26.

Cai Y, Lin C (2006). "Theory and Practice on Teacher Performance Evaluation", Front. Education China. 1: 29-39.

Mary CNC, Emilyn C (2007), "Sources of Efficiency and Productivity Growth in the Philippine State Universities and Colleges: A Non-Parametric Approach", Intl. Bus. Econs. Res. J. 6(6): 79-90.

Nina B, Blaženka D, Tihomir H (2007). "Development of AHP Based Model for Decision Making on E-Learning Implementation", J. Info. Org. Sci. 31(1): 13-24.

Mahapatra SS, Khan MS (2007). "A Neural Network Approach for Assessing Quality in Technical Education: An Empirical Study", Intl. J. Prod. Qual. Mgt. 2(3): 287-306.

Salmuni W, Mustaffa W, Hariri K (2007). "Prioritizing Academic Staff Performance Criteria in Higher Education Institutions to Global Standards", Proceedings of the 13th Asia Pacific Management Conference, Melbourne, Australia, pp. 1281-1288.

Edmundas Z, Milda V, Jonas Š (2007), "Sustainable Development Assessment of Cities and their Residential Districts", EKOLOGIJA, 53: 49-54.

Mónica GM, Pablo A B, Carmen M, González C (2008). "An AHP-Based Evaluation Procedure for Innovative Educational Projects*:* A Face-to-Face vs. Computer-Mediated Case Study", Omega, The Intl. J. Mgt. Sci. 36: 754-765.

Edmundas K Z, Zenonas T, Jolanta T, Valerija M (2008). "Multicriteria Selection of Project Managers by Applying Grey Criteria", Technological and Economic Development of Economy, Baltic J. Sustain. 14(4): 462-477.

Edmundas K Z, Zenonas T, Jolanta T, Valerija M (2008). "Selection of Construction Project Managers by Applying COPRAS-G Method", RelStat'08, 15-18 October 2008, Riga, Latvia.

Nerija B, Audrius B, Arturas K, Edmundas KZ (2008). "Evaluating the life cycle of a building: A multivariant and multiple criteria approach", Omega. 36(3): 429-441.