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MEASURING A QUALITY OF FACULTY WEBSITE USING ARAS METHOD

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Abstract. A significant increase in Internet usage has caused also significant changes in how companies conduct business and their interaction with other companies, governments and consumers. Faculties, as organizations which provide services, also need to pay attention to these changes, as well as the importance of their websites. Therefore, in this paper, we propose, an easy to use, multiple criteria decision making model for evaluation of a faculty Web site, based on the use of ARAS method.

Keywords: decision-making, Web site analysis, ARAS method.

Jel classification: D81, C61, C44.

1. Introduction

In the professional and scientific literature, a number of papers are devoted to the evaluation of the websites, and elements that are relevant for their quality.

For example, based on customer baying process Berthon, Pitt, and Watson (1996), and Merwe and Bekker (2003) indented a five groups of criteria, namely: Interface, Navigation, Content, Reliability and Technical. These groups of criteria also contain their sub-criteria. Albuquerque and Belchior (2002) also identified a number of criteria (quality factors), which can be used to evaluate the quality of an e-Commerce website. These criteria are organized in several hierarchical levels, where at the top of proposed hierarchical structure, the following criteria are placed: Usability, Conceptual reliability and Representation reliability.

Studies that are intended to identify the key criteria and their importance, are still actual. For example, Dumitrache (2010) gives an overview of criteria used for evaluation of e-Commerce sites in Romania, during the period 2006 and 2009. It also states Navigability, Response Time, Personalization, Tele-presence and Security as very important criteria. Davidaviciene and Tolvaisas (2011) identify the list of criterions for quality evaluation of e-Commerce website. They also provide a comprehensive overview of the criteria that have been recently proposed by different authors. In accordance with Davidaviciene and Tolvaisas (2011) criteria: Easy to use, Navigation, Security assurance, Help (real time) and Design have been discussed by numerous authors, such as (Loiacono *et al*. 2007; Parasuraman *et al*. 2007; Cao *et al*. 2005; Calero *et al*. 2005). Aydin and Kahraman (2011) proposed fuzzy multiple criteria decision making model for evaluation of e-Commerce websites. Their model contains five criteria and twenty sub-criteria, where the key criteria are: Ease of use, Products, Security, Customer relation ship and Fulfillments.

As can be concluded from the above, different authors have proposed different criteria and also different number of criteria for evaluating e-Commerce websites. In addition, the proposed criteria often have different meanings, and also different impact on overall quality of website.

Therefore, in this paper we consider evaluating and measuring the quality of a faculty website as a multiple criteria decision making (MCDM) problem. The aim of this paper is to form an easy to use but also effective MCDM model, which will provides an opportunity to decision makers to perform comparisons of a faculty website with web sites of other faculties. Therefore, for forming this model a relatively simple but effective MCDM method, called the ARAS method, is a chosen.

In relation to e-commerce websites, evaluation of faculty websites have their specifics. Therefore, in section 2 of this paper we discuss the criteria for measuring the quality of websites, identified by Kapoun (1998).Then, in section 3 of this paper, we present the basic elements of ARAS method.

After that, in the numerical example is presents the use of ARAS method for evaluating and measuring a quality of a faculty website.

2. The criteria for measuring a quality of a faculty website

For the purpose of forming a model that is easy to use, we decided to use of a small number of criteria, but sufficient for adequate evaluation. These criteria, adopted from Kapoun (1998), are:

- C_1 **– Accuracy of the Website** (***Ac***). The criterion Accuracy reflects the accuracy of the information available on the website.
  Criterion accuracy is very important when determining the quality of websites, especially other types of websites such as commercial, informational, and so on. In the case of faculty websites is expected that the information available on the site is accurate, and therefore, this criterion has no great significance. However, the lack of accuracy of information which are available on the faculty website can have a very significant impact on the quality of the website, and thus to the reputation of the faculty.
  Accuracy of information can be very important for prospective students, who based on information available on the website, and their accuracy, make judgments about the faculty.
- C_2 **– Authority of the Website** (***Au***)**.** Criteria Authority of Web document reflects how a person or institution responsible for the website has the qualifications and knowledge to do so.

In the case of faculties websites, to this criterion can be assigned little significance, because the staff at the universities has the necessary qualifications and knowledge. However, in some cases, this criterion is very important. Poor communication between teaching staff and administrators of the site, lack of understanding or lack of interest can result with reducing the authority and poor quality of a website.

- ***C_3* – Objectivity of the Website (*O*).** The criterion Objectivity reflects the objectivity of information available on the website.
  Competitive spirit, which exists between universities, sometimes can have a negative impact to the objectivity of information posted on the site. However, a large amount of non objectivity, caused by the competitive spirit, also can have a negative impact on the quality of the website.
- ***C_4* – Currency of the Website (*Cu*).** The criterion Currency of the website refers to: i) how current the information presented is; and ii) how often the site is updated or maintained.
  Insufficient or poor communication between the leadership of a faculty, academic staff and administrator of a website can lead to lack of currency, and also can significantly to reduce the quality of the website.
- ***C_5* – Coverage of the Website (*Co*).** Criterion Coverage refers to the compressibility of information and their hierarchical organization of the site. Adequate organization of information on the website can significantly reduce the search time and the use of links, and also increase customer satisfaction.

As shown using the previous steps, ARAS method has a simple to use a procedure which can be easily used for solving MCDM problems, even when this method is used by ordinary users.

3. A new additive ratio assessment (ARAS) method

A typical Multiple Criteria Decision Making (MCDM) problem, which contains m alternatives and *n* criteria, can be concisely expressed in a matrix form, as follows:

$$D = \begin{matrix} & C_1 & C_2 & \cdots & C_n \\ A_1 & x_{11} & x_{12} & \cdots & x_{1n} \\ A_2 & x_{12} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ A_m & x_{1n} & x_{2n} & \cdots & x_{mn} \end{matrix}, \quad (1)$$

$$W = [w_1, w_2, ..., w_n]$$

where A_1, A_2, ..., A_m are available alternatives, C_1, C_2, ..., C_n are criteria, x_{ij} is performance rating of *i*-th alternative with respect to *j*-th criterion, w_j is weight of *j*-th criterion, $i=1, 2, \ldots, m$, and $j=1, 2, \ldots, n$.

Over time, many MCDM methods have been formed, such as: Simple Additive Weighting (SAW) method (MacCrimon 1968), Compromise programming (Zeleny 1973; Yu 1973), Analytic Hierarchy Process (AHP) method (Saaty 1980), Technique for Ordering Preference by Similarity to Ideal Solution (TOPSIS) method (Hwang, Yoon 1981), Preference Ranking Organisation Method for Enrichment Evaluations (PROMETHEE) method (Brans, Vincke 1985), ELimination and Choice Expressing REality (ELECTRE) method (Roy 1991), COmplex PRoportional ASsessment (COPRAS) method (Zavadskas *et al.* 1994), VIKOR (VIsekriterijumska optimizacija i KOmpromisno Resenje, in Serbian means Multicriteria Optimization and Compromise Solution) method (Opricovic 1998), Multi-Objective Optimization on the basis of Ratio Analysis (MOORA) method (Brauers, Zavadskas 2006) and Multi-Objective Optimization by Ratio Analysis plus Full Multiplicative Form (MULTIMOORA) method (Brauers, Zavadskas 2010). Using any of them MCDM problems can be transformed into appropriate single criteria decision making problems, and based on that much easier be solved.

A new additive ratio assessment (ARAS) method was proposed by Zavadskas and Turskis (2010), and it can be classified as a newly formed, but effective and easy to use, MCDM method. The ARAS method has been applied to solve various decision-making problems, and also have been formed its fuzzy and grey extension, named ARAS-F (Turskis, Zavadskas 2010b) and ARAS-G (Turskis, Zavadskas 2010a). From many papers, here we mention only a few, such as: Zavadskas *et al.* (2010, 2012), and Bakshi and Sarkar (2011).

The procedure of solving problems by using ARAS methods can be precisely described by using the following steps:

***Step* 1**: **Determine optimal performance rating for each criterion**. After creating a decision matrix, the next step in the ARAS method is to determine the optimal performance rating for each criterion. If decision makers do not have preferences, the optimal performance ratings are calculated as:

$$x_{0j} = \begin{cases} \max_i x_{ij}; & j \in \Omega_{\max} \\ \min_i x_{ij}; & j \in \Omega_{\min} \end{cases}, \tag{2}$$

where x_{0j} is optimal performance rating in relation to the *j*-th criterion, $\Omega_{\max}$ denote a set of benefit type criteria, i.e. optimization direction is maximization; and $\Omega_{\min}$ denote a set of cost type criteria, i.e. optimization direction is minimization.

***Step* 2: Calculate the normalized decision matrix** $R=[r_{ij}]$. The normalized performance ratings are calculated by using the following formula:

$$r_{ij}=\begin{cases}\dfrac{x_{ij}}{\sum_{i=0}^{m}x_{ij}}; & j\in\Omega_{\max}\\ \dfrac{1/x_{ij}}{\sum_{i=0}^{m}1/x_{ij}}; & j\in\Omega_{\min}\end{cases}, \quad (3)$$

where r_{ij} is normalized performance rating of ***i***-th alternative in relation to the ***j***-th criterion.

***Step* 3: Calculate the weighted normalized decision matrix** $V=[v_{ij}]$. The weighted normalized performance ratings are calculated by using the following formula:

$$v_{ij}=w_j\cdot r_{ij};\ i=1,2,\ldots,m, \quad (4)$$

where v_{ij} is weighted normalized performance rating of ***i***-th alternative in relation to the ***j***-th criterion.

***Step* 4: Calculate the overall performance index for each alternative.** The overall performance index S_i, for each alternative, can be calculated as the sum of weighted normalized performance ratings, using the following formula:

$$S_i=\sum_{j=1}^{n}v_{ij};\ i=0,1,\ldots m. \quad (5)$$

***Step* 5: Calculate the degree of utility for each alternative.** In the case of evaluating faculty websites, it is not only important to determine the best ranked website. There is also important to determine relative quality of considered websites, in relation to the best ranked website. For this we use degree of utility, which can be calculated using the following formula:

$$Q_i=\frac{S_i}{S_0};\ i=1,2,\ldots,m, \quad (6)$$

where Q_i is degree of utility of ***i***-th alternative, and S_0 is overall performance index of optimal alternative, and it is usually 1.

The largest value of Q_i is the best and the smallest one is the worst.

***Step* 6: Rank alternatives and/or select the most efficient one.** The considered alternatives are ranked by ascending Q_i, i.e. the alternatives with greater values of Q_i have a higher priority (rank) and the alternative with the largest value of Q_i is the best placed. Therefore, determination of the most appropriate alternative, A^*, can be done with the following formula:

$$A^* = \left\{ A_i \middle| \max_i Q_i \right\};\ i = 1,2,\ldots,m. \quad (7)$$

4. A Numerical Example

To present the effectiveness of the proposed methodology, in this section, we present the partial results taken from a survey that was conducted in order to determine the quality of the websites of some universities in Serbia.

Criteria weights, obtained on based on the opinions of a group of students, and the use of pairwise comparison obtained from the AHP method, are shown in Table 1.

Table 1. The criteria weight

Criteria		w_j
C_1	*Ac*	0.10
C_2	*Au*	0.17
C_3	*O*	0.13
C_4	*Cu*	0.32
C_5	*Co*	0.28

The data obtained on the basis of evaluation faculty websites obtained from three students are shown in Tables 2, 3 and 4.

Table 2. The data obtained from the first student

	Ac	*Au*	*O*	*Cu*	*Co*
A_1	8	9	8	7	8
A_2	7	8	9	8	7
A_3	9	9	9	9	8

Table 3. The data obtained from the second student

	Ac	*Au*	*O*	*Cu*	*Co*
A_1	8	9	8	6	7
A_2	8	9	9	9	7
A_3	9	9	9	9	8

Table 4. The data obtained from the third student

	Ac	*Au*	*O*	*Cu*	*Co*
A_1	7	8	8	8	8
A_2	7	8	8	9	8
A_3	8	9	9	8	9

For evaluation, respondents have used assessment scale from 1 to 10. Average performance ratings, shown in Table 5, obtained on the basis of a group of *K* respondents, were calculated using the following formula:

$$x_{ij} = \left(\prod_{j=1}^{k} x_{ij}^{k} \right)^{\frac{1}{K}}, \tag{8}$$

where x_{ij}^{k} is performance ratings of *i*-th alternative with respect to *j*-th criterion obtained from *k*-th respondent, *k*=1, 2, …, *K*, and *K* is the number of decision makers.

Table 5. The average performance ratings

	Ac	*Au*	*O*	*Cu*	*Co*
A_0	8.65	9.00	9.00	8.65	8.32
A_1	7.65	8.65	8.00	6.95	7.65
A_2	7.32	8.32	8.65	8.65	7.32
A_3	8.65	9.00	9.00	8.65	8.32

In Table 5 are also, in the column A_0, are shown optimal performance ratings, determined using the Formula (2). Normalized performance ratings, determined using the Formula (3), are shown in Table 6.

Table 6. The normalized decision matrix

	Ac	*Au*	*O*	*Cu*	*Co*
A_1	0.24	0.25	0.23	0.21	0.24
A_2	0.23	0.24	0.25	0.26	0.23
A_3	0.27	0.26	0.26	0.26	0.26

Weighted normalized performance ratings, determined using the Formula (4), are shown in Table 7.

Table 7. The weighted normalized decision matrix

	Ac	*Au*	*O*	*Cu*	*Co*
A_1	0.024	0.041	0.029	0.068	0.068
A_2	0.023	0.040	0.032	0.085	0.065
A_3	0.027	0.043	0.033	0.085	0.074

The overall performance indexes and is degrees' of utility, obtained by using the formulae (5) and (6), are shown in Table8.

Table 8. The overall performance indexes and degrees' of utility

	S_i	Q_i	*Rank*
A_1	0.231	0.88	3
A_2	0.245	0.93	2
A_3	0.262	1.00	1

In the considered example, for clearer presentation, websites of three characteristic universities are chosen. The results shown in Table 8 clearly prove that.

Faculty website labeled as A_3 is representative of universities who devote significant attention to their websites.

In contrast, the faculty A_1 was chosen as an example of the universities which can be characterized by a lack of intention to recognize and adopt importance of their websites, or universities which can be characterized by inadequate communication between their teaching staff and administrators of websites.

By using the relative performance index instead of the overall index, much better can be determined its quality compared to competitive websites, and on this basis much better specify actions that are needed to improve its quality.

5. Conclusions

The faculty website is very important in a competitive environment, which also exists between the various universities and faculties. The faculty website has several purposes, such as: i) providing information to prospective students, ii) the provision of information to students, and so on.

In the presented case, some general evaluation criteria and an effective and simple to use MCDM method are used.

With more precise identifications of typical users of faculty websites, more precise identification of their needs and a more precise determination of the importance of key evaluation criteria, can be formed MCDM models which will allow more precise measurement of the quality of faculty websites.

Based on existing literature and information available from the Internet, we are not convinced that to the mentioned problem was given enough attention. Therefore, one of the goals of this paper is to initiate further research that will lead to a greater quality of faculty websites.

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