Selection of Best Web Site by Applying COPRAS-G method

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Abstract— **The presence of multiple websites offering similar services has changed the user outlook. The user now prefers to visit those sites, which are easy to use. Many different methods have been proposed to measure usage of a website. The quantitative methods focus on the performance measurement of the website whereas the qualitative methods estimate the user's opinion of a website. In this paper we propose a distinct measure, which combines the qualitative, quantitative factors referred in the literature with rarely mentioned factors such as trust and feature state. The measure thus obtained determines the usage of a website from the user view point .It can be employed to compare usage of different websites. Attributes and sub-attributes were identified in the selection of best web site. The model is based on multi-attribute evaluation of web site. The evaluation embraces the identified attributes influencing the process of selection of web sites. The evaluation methods are used for the effectiveness of web site is a critical issue in both practice and research. The evaluation process involves human subjectivity and it is a multiple-criteria decision making (MCDM) problem in the presence of many quantitative and qualitative attributes. This paper considers the application of Grey Relations Methodology for defining the Utility of alternatives, and a multiple criteria method of COmplex PRoportional ASsessment of alternatives with Grey relations (COPRAS-G) is offered. The study has investigated three web sites with the proposed method. In this model, the parameters of the alternatives are determined by the Grey relational grade and expressed in intervals. A case study presents the selection of Best web site. The results obtained show that this method may be used as an effective decision aid in multi-attribute selection.**

Keywords- Web Site Evaluation, AHP , Web Mining, COPRAS, Grey relations;

1. Introduction

With the abundance of information available on the World Wide Web (WWW), it has become increasingly necessary for users to find the desired information resources. Web mining is the use of data mining techniques to automatically discover and extract information from Web documents and services.

Web mining refers to the effort of Knowledge Discovery Data (KDD) from the web. It can be defined as the process of applying data mining techniques to extract useful knowledge from the huge amount of information available from the web. It is often categorized into three major areas [1, 2]:

Web content mining: Mining of text, image, audio, video, Meta data and hypertexts in order to extract useful concepts and rules and summarize the content on the web.

Web content mining has to do with the retrieval of information (content) available on the Web into more structured forms as well as its indexing for easy tracking information locations. Web content may be unstructured (plain text), semi structured (HTML documents), or structured (extracted from databases into dynamic Web pages).

Web structure mining: Mining of underlying link structures of the web in order to categorize web pages, measure similarities and reveal relationships between different websites.

The goal of Web structure mining is to categorize the Web pages and generate information such as the similarity and relationship between them, taking advantage of their hyperlink topology. In the latter years, the area of Web structure mining focuses on the identification of authorities, i.e. pages that are considered as important sources of information from many people in the Web community.

Web usage mining: Mining of the data generated by the web users interactions with the web, including web server access logs, user queries and mouse clicks in order to extract patterns and trends in web user's behavior.

The presence of multiple websites offering similar services has changed the user outlook. The user now prefers to visit those sites, which are easy to use. Many different methods have been proposed to measure usage of a website. The quantitative methods focus on the performance measurement of the website whereas the qualitative methods estimate the user's opinion of a website. The measure thus obtained determines the usage of a website from the user view point .It can be employed to compare usage of different websites. With many websites offering similar facilities, the user today has become more demanding in respect of the web access. Users prefer visiting those sites, which are easy to learn and operate .The usage of a website plays a significant role in determining the number of hits to a website. Websites can primarily be classified into 3 main categories, the information-oriented websites, the service-rendering websites and the business-oriented websites. By considering the following criteria's we can able to select best web site:

Web Site Quality

- Web Appearance (Web Structure)
- Searching Function (Web Structure)
- Site Navigation Path (Web Usage)
- Response time (Web Usage)
- Bytes of data transferred (Web Usage)
- Hit ratio (Web Usage)
- Web site visiting speed (Web Usage)
- Error Status (Web Usage).

Information Quality

- Understandability(Web Content)
- Accuracy(Web Content)
- Reliability(Web Content)
- Hit ratio(Web Usage)
- Timeliness(Web Usage)

The rest of this paper is organized as follows. First, AHP method is reviewed, General criteria for Evaluating Web Sites are explained in section 3, COPRAS-G method explained in detail in section 4. An illustrating example is given in Section 5. Finally, the conclusion is drawn out in Section 6.

2. AHP Methodology

The analytic hierarchy process (AHP) developed by Saaty (1980)[3] is a powerful and flexible multi-criteria decision making tool for complex problems where both qualitative and quantitative aspects need to be considered. Its main characteristic is that it is based on pair wise comparison judgments. It is a decision-rule model that relaxes the measurement of related factors to subjective managerial inputs on multiple criteria. By reducing complex decisions to a series of simple comparisons and rankings, then synthesizing the results, the AHP not only helps the analysts to arrive at the best decision, but also provides a clear rationale for the choices made. The use of AHP does not involve cumbersome mathematics. AHP involves the principles of decomposition, pair wise comparisons, and priority vector generation and synthesis. According to the principles of the analytic hierarchy process, this paper constructs evaluation index system of website.

A multi-level analytical structure as shown in Fig. 1.

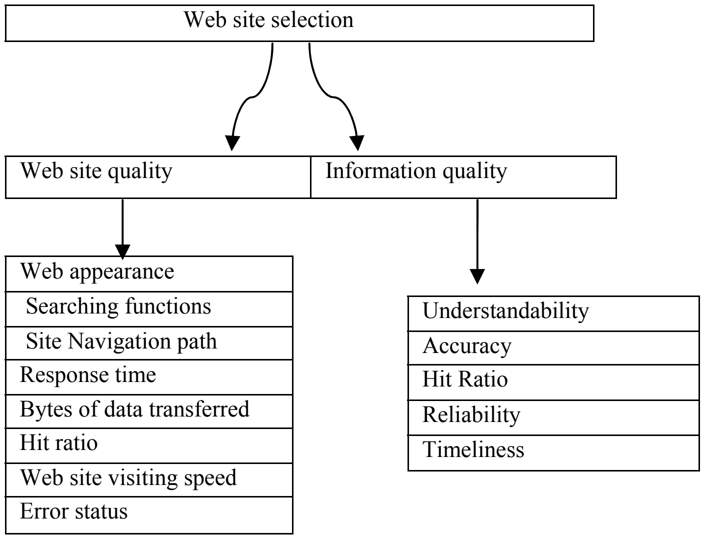


Fig.1. Multi-level analytical structure

Analytical hierarchy process(AHP) consists of following steps:

1) Define decision criteria in the form of a hierarchy of objectives.

AHP uses a standardized comparison scale for relative importance shown in Table 1 to make the pair-wise comparison, the comparisons done in any two indexes of commercial indexes by using "Proportion Criteria 1---9.

Table 1: Scale for Relative Importance

Intensity of importance	Definition	Intensity of importance	Definition
1	Equal importance	2	weak
3	Moderate importance	4	Moderate plus
5	Strong importance	6	Strong plus
7	Very strong importance	8	Very, very strong
9	Extreme importance		

If they are equally important then to take 1;If the former is slightly important than the latter then the former taking 3 and the latter taking 1 / 3; If the former is strongly important than the latter then the former taking 5 and the latter taking 1 / 5;If the former is very strongly important than the latter then the former taking 7 and the latter taking 1 / 7;If the former is extremely important than the latter then the former taking 9 and the latter taking 1 / 9; Between their values are for 2, 4, 6, 8.

2) Development of judgment matrices A by pair wise comparisons:

$$A = \{a_{ij}\} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & \cdots & a_{nn} \end{bmatrix} \quad (1)$$

3) After a judgment matrix, a priority vector to weight the elements of the matrix is calculated.

$$W_i = \sqrt[n]{\prod_{j=1}^{n} a_{ij}} \Big/ \sum_{i=1}^{n} \sqrt[n]{\prod_{j=1}^{n} a_{ij}} \quad (i,j=1,2,...,n) \quad (2)$$

4) After the generation of priority vector, inconsistency in pair-wise comparison may occur due to subjective human judgment error. Therefore, it is important to check the consistency in response through a consistency index (CI) by using the following equation.

$$CI = (\lambda max - n)/(n-1) \quad (3)$$

5) Finally, the consistency ratio (CR) calculated as the ratio of the CI and the random consistency index (RCI), which is shown in Table 2.

$$CR = CI/RCI \quad (4)$$

Table 2: Random Consistency Index

Matrix Rank	1	2	3	4	5	6	7	8
RI	0.0	0.0	0.58	0.90	1.12	1.24	1.32	1.41

When the *CR<0.10,* we think the judging matrix has satisfying consistency. Otherwise, the comparison matrices are not consistent; we should adjust the elements in the matrixes and carry out a consistency test until they are consistent.

We can calculate the weights of the hierarchical structure for web site assessment by the AHP method. The exact weights of main criteria are obtained as:

w_1 =0.5 (web site quality);

w_2 =0.5 (information quality);

All sub-criteria are compared at the second level in terms of corresponding main criteria. By using the same prioritization method, the local weights of sub-criteria are calculated as the results of Table3.

Table 3: Results from Judgment Matrices of Sub-Criteria

Level 1 : criteria	Weight	Level 2 : criteria	Weight
Web Site Quality	0.50	Web appearance	0.125
		Searching Function	0.125
		Site navigation	0.125
		Response time	0.130
		Bytes of data transferred	0.125
		Hit ratio	0.130
		Web site visiting speed	0.125
		Error Status	0.115
Information Quality	0.50	Understandability	0.2
		Accuracy	0.2
		Reliability	0.2
		Hit ratio	0.2
		Timeliness	0.2

3. General Criteria for Evaluating Web Sites

Evaluating a web site is no different than evaluating any other instructional tool. While the structure of a web page is different from a printed page, what constitutes good content is not. When you are determining how valuable a web site is as an instructional source, you should consider the following:

Does the page has content or is it only links to other sites?

Is the information accurate?

- Is the information useful for your purpose?
- Is the primary purpose of the site advertising or is it informational?
- Does the information contradict something you already know or have learned from another source?
- Is the information free from bias?
- Is the information current?
- When was the web site created?
- When it was last updated?
- Is the information more easily obtained from another source?

Is the author or the creator credible?

- Is the author identified?

How easy is it to navigate within the web site?

- If the document is long, are links provided to move through the document?

- If the document is made of multiple pages, are links provided to return to the home page? To preceding pages?

4. Methodology

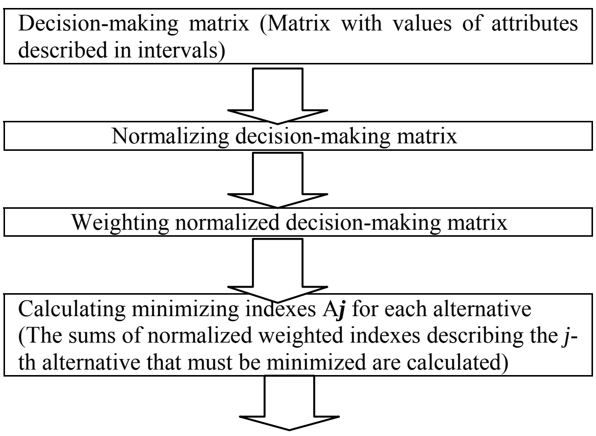
4.1. A method of multiple criteria COmplex PRoportional ASsessment

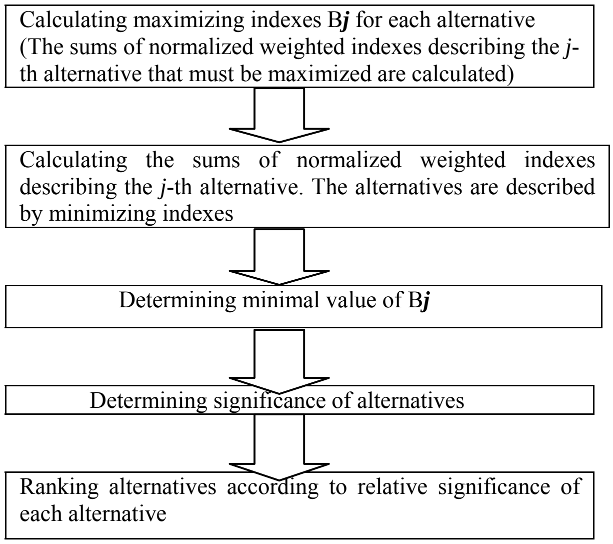
In order to evaluate the overall efficiency of web sites, it is necessary to identify selection attributes, to assess information, relating to these attributes, and to develop methods for evaluating the attributes to meet the user's needs. Decision analysis is concerned with the situation in which a decision-maker has to choose among several alternatives by considering a particular set of attributes. The COPRAS method [11] presented in the paper uses a stepwise ranking and evaluating procedure of the alternatives in terms of significance and utility degree. This method was applied to the solution of various problems in construction [4, 5, and 6].

4.2. A method of multiple criteria COmplex PRoportional ASsessment with values expressed in intervals

In 1982, Deng developed the Grey system theory [7]. In 1988, Deng [8] presented Grey decision-making systems. According to Deng [9], the Grey relational analysis has some advantages: it involves simple calculations and requires a smaller number of samples; a typical distribution of samples is not needed; the quantified outcomes from the Grey relational grade do not result in contradictory conclusions to qualitative analysis; the Grey relational grade model is a transfer functional model that is effective in dealing with discrete data. The idea of COPRAS-G method is based on the real conditions of decision making and applications of the Grey systems theory. In 2008, Zavadskas *et al.* developed the COPRAS-G method [10].COPRAS-G method was applied to the selection of the effective walls for a dwelling house [10]. COPRAS-G method was applied to the selection of the effective walls for a dwelling house [10].

Figure 2: Ranking of alternatives by applying COPRAS-G method





The procedure of using the COPRAS-G method with attribute values expressed in intervals consists in the following steps:

1. Selecting the set of the most important attributes, describing the alternatives;
2. Constructing the decision-making matrix D:

$$= \begin{bmatrix} [l_{11}; u_{11}] & [l_{12}; u_{12}] & \cdots & [l_{1m}; u_{1m}] \\ [l_{21}; u_{21}] & [l_{22}; u_{22}] & \cdots & [l_{2m}; u_{2m}] \\ \vdots & \vdots & \cdots & \vdots \\ [l_{n1}; u_{n1}] & [l_{n2}; u_{n2}] & \cdots & [l_{nm}; u_{nm}] \end{bmatrix}$$

$$j = \overline{1,n};\ i=\overline{1,m}; \quad (5)$$

Where l_{ij} is the smallest value, the lower limit, u_{ij} is the biggest value, the upper limit.

3. Determining weights of the attributes w_j by using AHP.
4. Normalizing the decision-making matrix D. The normalized values of this matrix are calculated as follows:

$$\bar{l}_{ij} = \frac{l_{ij}}{1/2\left(\sum_{j=1}^{m} l_{ij} + \sum_{j=1}^{m} u_{ij}\right)} = \frac{2 l_{ij}}{\left(\sum_{j=1}^{m} l_{ij} + \sum_{j=1}^{m} u_{ij}\right)} \quad (6)$$

$$\bar{u}_{ij} = \frac{u_{ij}}{1/2\left(\sum_{j=1}^{m} l_{ij} + \sum_{j=1}^{m} u_{ij}\right)} = \frac{2 u_{ij}}{\left(\sum_{j=1}^{m} l_{ij} + \sum_{j=1}^{m} u_{ij}\right)} \quad (7)$$

$$i = \overline{1,n}; \quad j=\overline{1,m};$$

In formula (6, 7), l_{ij} is the lower value of the *j* attribute in the i *alternative* of the solution; u_{ij} is the upper value of the *j* attribute in the *i* alternative of the solution; *m* is the number of attributes; *n* is the number of the alternatives compared.

Then, the normalized decision-making matrix is:

$$\bar{D} = \begin{bmatrix} [\bar{l}_{11}; \bar{u}_{11}] & [\bar{l}_{12}; \bar{u}_{12}] & \cdots & [\bar{l}_{1m}; \bar{u}_{1m}] \\ [\bar{l}_{21}; \bar{u}_{21}] & [\bar{l}_{22}; \bar{u}_{22}] & \cdots & [\bar{l}_{2m}; \bar{u}_{2m}] \\ \vdots & \vdots & \vdots & \vdots \\ [\bar{l}_{n1}; \bar{u}_{n1}] & [\bar{l}_{n2}; \bar{u}_{n2}] & \cdots & [\bar{l}_{nm}; \bar{u}_{nm}] \end{bmatrix}$$

In formula (8), w_j is the significance (weight) of the j^{th} attribute. Then, the weighted normalized decision-making matrix is:

$$\hat{D} = \begin{bmatrix} [\hat{l}_{11}; \hat{u}_{11}] & [\hat{l}_{12}; \hat{u}_{12}] & \cdots & [\hat{l}_{1m}; \hat{u}_{1m}] \\ [\hat{l}_{21}; \hat{u}_{21}] & [\hat{l}_{22}; \hat{u}_{22}] & \cdots & [\hat{l}_{2m}; \hat{u}_{2m}] \\ \vdots & \vdots & \vdots & \vdots \\ [\hat{l}_{n1}; \hat{u}_{n1}] & [\hat{l}_{n2}; \hat{u}_{n2}] & \cdots & [\hat{l}_{nm}; \hat{u}_{nm}] \end{bmatrix} \quad (9)$$

6. Calculating the sums A_j of the attribute values, whose larger values are more preferable (optimization direction is maximization), for each alternative (each row of the decision-making matrix):

$$A_j = 1/2 \sum_{i=1}^{k} (\hat{l}_{ij} + \hat{u}_{ij}) \quad (10)$$

In formula (10), ***k*** is the number of attributes which must be maximized (it is assumed that, in the columns of decision-making matrix, the attributes with optimization direction maximum are placed first and only then the attributes with optimization direction minimum are inserted).

7. Calculating the sums B_j of attribute values, whose smaller values are more preferable (optimization direction is minimization), for each alternative (each row of the decision-making matrix):

$$B_j = 1/2 \sum_{i=k+1}^{m} (\hat{l}_{ij} + \hat{u}_{ij}); \quad i = \overline{k, m} \quad (11)$$

In formula (11), $(m - k)$ is the number of attributes which must be minimized.

8. Determining the minimal value of B_j:

$$B_{min} = \min_j B_j \; ; \; j = \overline{1, m}$$

9. Calculating the relative weight of each alternative W_j *:*

$$W_j = A_j + \frac{B_{min} \sum_{j=1}^{m} B_j}{B_j \sum_{j=1}^{m} \frac{B_{min}}{B_j}} \quad \text{(or)} \quad A_j + \frac{\sum_{j=1}^{m} B_j}{B_j \sum_{j=1}^{m} \frac{1}{B_j}} \quad (13)$$

10. Determining the optimality criterion ***K***:

5. Calculating the weighted normalized decision matrix $\hat{D}$.The weighted normalized values $\hat{D}_{ij}$ are calculated as follows:

$$\hat{l}_{ij} = \bar{l}_{ij} . w_j; \qquad \hat{u}_{ij} = \bar{u}_{ij} . w_j; \quad (8)$$

$$K = \max_j W_j \; ; \; j = \overline{1, n} \quad (14)$$

11. Determining the priority of the web sites. The greater the significance (relative weight of alternative) W_j , the higher the priority (rank) of the web site. The relative significance W_j of web site *j* indicates the satisfaction degree of the needs of the web sites performance. In the case of W_{max} the satisfaction degree is the highest compared to the relative significance of other web sites.

12. Calculating the utility degree of each alternative. The degree of project utility is determined by comparing the analyzed web sites with the best web site. The values of the utility degree range from 0% to 100% between the worst and the best alternatives. The utility degree N_j of each alternative j is calculated as follows:

$$N_j = \frac{W_j}{W_{max}} * 100\% \quad (15)$$

Where W_j & W_{max} are the significances of projects obtained from eq.(15) .The decision approach proposed in this section allows the evaluation of the direct and proportional dependence of the significance and utility degree of the alternatives on a system of attributes, weights and attribute values.

5. CASE STUDY: The Selection of Best Web Sites Applying COPRAS-G Method

We have done some case study on three web sites A, B and C by considering the different attributes.

Optimization directions of the selected attributes are as follows:

For Web Site Quality:

$d1, d2, d3, d5, d6, d7 \longrightarrow max$#

$d4, d8$ min#

For Information Quality:

$d1, d2, d3, d4$ max#

$d5 \longrightarrow min\#$

1. Selecting the set of the most important attributes, describing the alternatives.

Level 0 : Best Web Site Selection

Level 1 : Web Site Quality

- ❖ Web Appearance
- ❖ Searching Function
- ❖ Site Navigation Path
- ❖ Response time
- ❖ Bytes of data transferred
- ❖ Hit ratio
- ❖ Web site visiting speed
- ❖ Status.

Level 1: Information Quality

- ❖ Understandability
- ❖ Accuracy
- ❖ Reliability
- ❖ Hit ratio
- ❖ Timeliness

2. Constructing the decision-making matrix D shown in Table 5.a & 5.b.

a. $D_{\text{web site quality}}$

b. $D_{\text{information quality}}$

3. Determining weights of the attributes wj :

According to the AHP method, the weights of the hierarchical structure calculated as follow:

$W = (W_1, W_2) =$ (0.5, 0.5);

$W_{1i} = (W_{11}, W_{12}, W_{13}, W_{14}, W_{15}, W_{16}, W_{17}, W_{18})$

= (0.125, 0.125, 0.125, 0.130, 0.125, 0.130, 0.125, 0.115);

$W_{2i} = (W_{21}, W_{22}, W_{23}, W_{24}, W_{25})$ = (0.2, 0.2, 0.2, 0.2, 0.2);

4. Normalizing the decision-making matrix D according to Eq: 6&7.

$$\overline{D_{website\ quality}} = \begin{bmatrix} [0.32, 0.36] & [0.31, 0.4] & [0.25, 0.38] & [0.23, 0.38] & [0.29, 0.4] \\ [0.27, 0.36] & [0.31, 0.35] & [0.30, 0.35] & [0.23, 0.36] & [0.29, 0.4] \\ [0.27, 0.39] & [0.26, 0.35] & [0.30, 0.38] & [0.23, 0.38] & [0.25, 0.35] \end{bmatrix}$$

$$\begin{matrix} [0.316, 0.376] & [0.315, 0.368] & [0.275, 0.367] \\ [0.316, 0.386] & [0.268, 0.368] & [0.321, 0.367] \\ [0.277, 0.376] & [0.315, 0.368] & [0.321, 0.344] \end{matrix}$$

$$\overline{D_{Information\ quality}} =$$

$$\begin{bmatrix} [0.30, 0.39] & [0.32, 0.36] & [0.32, 0.36] & [0.29, 0.27] & [0.29, 0.39] \\ [0.30, 0.36] & [0.3, 0.36] & [0.28, 0.32] & [0.27, 0.36] & [0.29, 0.37] \\ [0.26, 0.36] & [0.28, 0.38] & [0.32, 0.36] & [0.31, 0.34] & [0.29, 0.34] \end{bmatrix}$$

5. Calculating the weighted Normalized decision-making matrix $\hat{D}$ according to E.q:8.

$$\hat{D}_{Web\ site\ quality} = \begin{bmatrix} [0.04, 0.04] & [0.03, 0.05] & [0.03, 0.04] & [0.03, 0.05] & [0.03, 0.05] \\ [0.03, 0.04] & [0.03, 0.04] & [0.03, 0.04] & [0.03, 0.04] & [0.03, 0.05] \\ [0.03, 0.04] & [0.03, 0.04] & [0.03, 0.04] & [0.03, 0.05] & [0.03, 0.04] \end{bmatrix}$$

$$\begin{matrix} [0.04, 0.04] & [0.03, 0.04] & [0.03, 0.04] \\ [0.04, 0.04] & [0.03, 0.04] & [0.03, 0.04] \\ [0.03, 0.04] & [0.03, 0.04] & [0.03, 0.03] \end{matrix}$$

$$\hat{D}_{Information\ quality} = \begin{bmatrix} [0.060, 0.070] & [0.064, 0.072] & [0.065, 0.073] & [0.059, 0.055] & [0.059, 0.079] \\ [0.060, 0.073] & [0.060, 0.072] & [0.057, 0.065] & [0.055, 0.072] & [0.059, 0.074] \\ [0.052, 0.073] & [0.056, 0.076] & [0.065, 0.073] & [0.063, 0.068] & [0.059, 0.069] \end{bmatrix}$$

6 Calculating the sums A_j of the attribute values, whose larger values are more preferable (optimization direction is maximization), for each alternative (each row of the decision-making matrix):

Fig 3: Web Site Quality Optimization Direction is Maximization

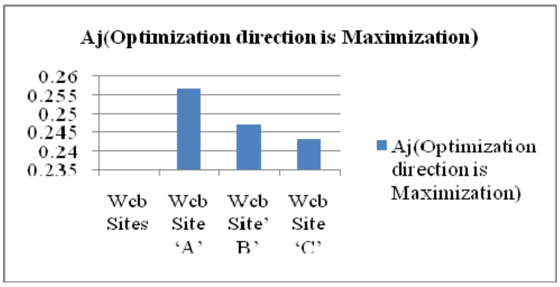
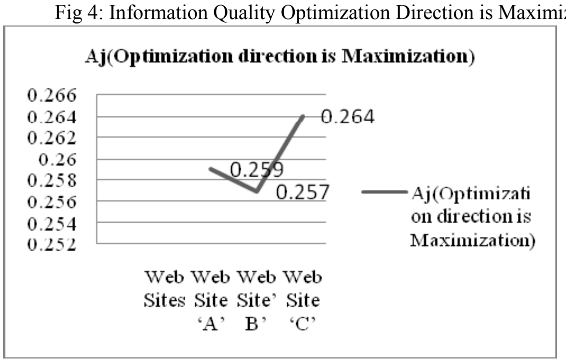


Fig 4: Information Quality Optimization Direction is Maximization



7. Calculating the sums B_j of attribute values, whose smaller values are more preferable (optimization direction is minimization), for each alternative (each row of the decision-making matrix):

Fig 5: Web Site Quality Optimization Direction is Minimization

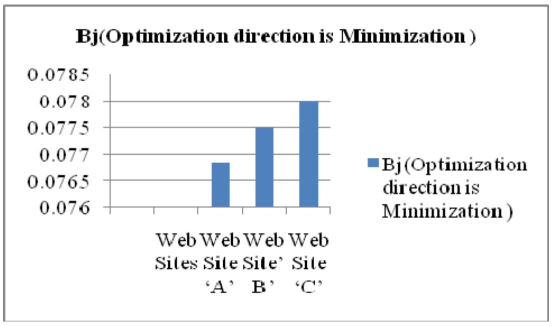
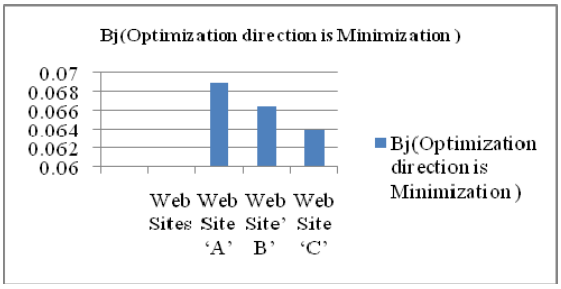


Fig 6: Information Quality Optimization Direction is Minimization



8. Determining the minimal value of B_j:

Web site quality B_{min} = 0.07685;

Information quality B_{min} = 0.064;

9. Calculating the relative weight of each alternative W_j :

Fig 7: Web Site Quality Relative Significance

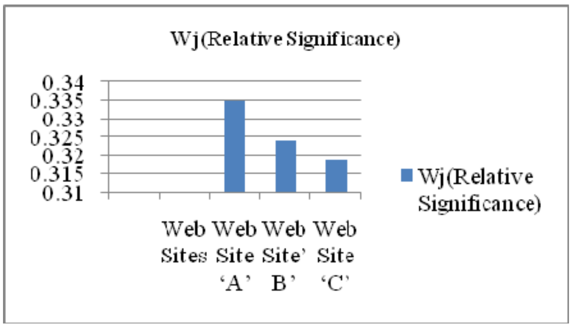
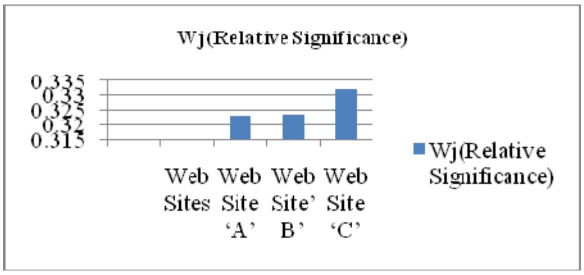


Fig 8: Information Quality Relative Significance



10. Determining the optimality criterion ***K***:

$K = max_j W_j = 0.6578$; j=1,3

11. Determining the priority of the web sites & calculating the Utility degree of each alternative:

Fig 9: priority and utility degree web sites

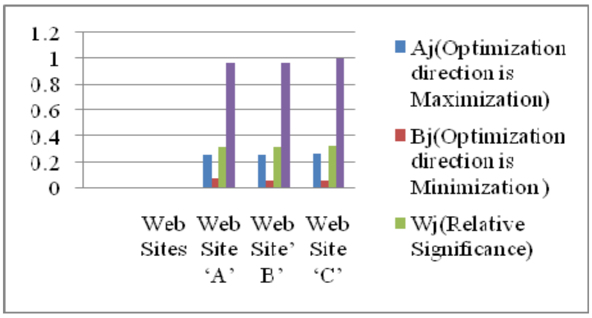


Fig 10: Utility degree for different website

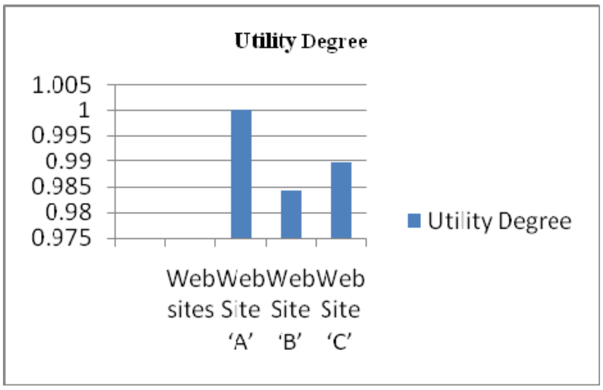


Table 4: Overall Utility Degree of different Web Sites:

	A_j(Optimization direction is Maximization)		B_j(Optimization direction is Minimization)		W_j(Relative Significance)		N_j(Utility Degree) in percentages	
	Web Site Quality	Information Quality	Web Site Quality	Information Quality	Web Site Quality	Information Quality	Web Site Quality	Information Quality
Web Site 'A'	0.2568	0.259	0.07685	0.069	0.3348	0.323	100%	97.28%
Web Site' B'	0.247	0.257	0.0775	0.0665	0.324	0.3235	96.7%	97.43%
Web Site 'C'	0.243	0.264	0.078	0.064	0.319	0.332	95.28%	100%

Table 5.a: Initial decision-making matrix web site Quality with the attribute values described in intervals and weighted normalized values of the attributes.

criteria's / Web Sites	Web appearance		Searching function		Site navigation		Response time		Bytes of data transferred		Hit ratio		Web site visiting speed		Error status	
	L_i	U_i	L_i	U_i	L_i	U_i	L_i	U_i	L_i	U_i	L_i	U_i	L_i	U_i	L_i	U_i
Optimization Direction	max		max		Max		Min		max		max		max		min	
Attribute Weight (wj)	0.125		0.125		0.125		0.130		0.125		0.130		0.125		0.115	
	d_1		d_2		d_3		d_4		d_5		d_6		d_7		d_8	
Web site A	70	80	70	90	50	75	60	80	70	95	80	95	60	70	60	80
Web site B	60	70	70	80	60	70	60	75	70	95	80	85	50	70	70	80
Web site C	60	85	60	80	60	75	60	80	60	85	70	95	60	70	70	75
	L_i	U_i	L_i	U_i	L_i	U_i	L_i	U_i	L_i	U_i	L_i	U_i	L_i	U_i	L_i	U_i
Web site A	0.040	0.045	0.038	0.05	0.032	0.048	0.030	0.050	0.0367	0.05	0.041	0.048	0.039	0.046	0.0317	0.042
Web site B	0.034	0.045	0.038	0.044	0.038	0.044	0.030	0.046	0.036	0.05	0.041	0.043	0.032	0.046	0.037	0.042
Web site C	0.034	0.048	0,033	0.044	0.038	0.048	0.030	0.050	0.0315	0.041	0.036	0.048	0.039	0.046	0.037	0.039

Table 5 .b: Initial decision-making matrix of Information Quality with the attribute values described in intervals and weighted normalized values of the attributes:

criteria's / Web Sites	Understandability		Accuracy		Reliability		Hit ratio		Timeliness	
	L_i	U_i	L_i	U_i	L_i	U_i	L_i	U_i	L_i	U_i
Optimization Direction	Max		Max		max		max		min	
Attribute Weight (wj)	0.2		0.2		0.2		0.2		0.2	
	d_1		d_2		d_3		d_4		d_5	
Web site A	70	90	80	90	80	90	70	95	60	80
Web site B	70	85	75	90	70	80	65	85	60	75
Web site C	60	85	70	95	80	90	75	80	60	70
	L_i	U_i	L_i	U_i	L_i	U_i	L_i	U_i	L_i	U_i
Web site A	0.060	0.07	0.064	0.072	0.065	0.073	0.059	0.055	0.059	0.079
Web site B	0.06	0.073	0.06	0.072	0.057	0.065	0.055	0.072	0.059	0.074
Web site C	0.052	0.073	0.056	0.076	0.065	0.073	0.063	0.068	0.059	0.069

6. Conclusion

In actual multi-attribute modeling of multi-alternative assessment problems, attribute values referring to the future can be expressed in intervals.COPRAS-G is a newly developed method for assessment of alternatives by multiple-attribute values expressed in 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 the solution of a wide range of problems associated with the selection of best Web site by using discrete multi-attribute assessment technique. The inclusion of measures of factors such as the Understandability, Reliability, Accuracy, Appearance, Web Site Visiting Speed and Satisfaction ensure that to choose Best Web Site. This is necessary as these guide the outlook of a user towards a website and hence its usage. Assigning weights to these factors ensure that the parameters are measured as per their significance. A complete measure of utility is obtained. This measure is based on the existing quantitative, qualitative aspects of usage. The measure consolidates the different views of usability, the performance oriented, by measuring the effectiveness and efficiency. A measure of usage thus obtained can act as a benchmark for evolving and comparing the usage of different websites.

References

[1] R. Kosala, H. Blockeel, Web mining research: a survey, ACM SIGKDD Explorations Newsletter 2 (1) (2000)1–15.
[2] F. M. Facca and P. L. Lanzi, "Mining interesting knowledge from web logs: a survey," Data & Knowledge Engineering, vol. 53, pp. 225-241, 2005.
[3] T. L. Saaty, the Analytic Hierarchy Process. New York: McGraw-Hill, 1980
[4] Kaklauskas, A., Zavadskas, E.K., Raslanas, S., Ginevicius, R., Komka, A., Malinauskas, P. Selection of Low-e tribute in retrofit of public buildings by applying multiple criteria method COPRAS: A Lithuanian case. *Energy and buildings*, Vol. 38, 2006, pp. 454-462.
[5] Viteikiene, M., Zavadskas, E.K. Evaluating the sustainability of Vilnius city residential areas, *Journal of civil engineering and management*, Vol. 8, No 2, 2007, pp. 149-155.
[6] Zavadskas, E.K., Kaklauskas, A., Peldschus, F., Turskis, Z. Multi-attribute assessment of road design solution by using the COPRAS method, *The Baltic journal of road and bridge engineering*, Vol. 2, No 4, 2007, pp. 195-203.
[7] Deng, J.L. Control problems of Grey system, *Systems and control letters*, Vol. 1, No 5, 1982, pp. 288-294.
[8] Deng, J.L. Introduction to Grey System Theory, *The journal of Grey theory*, Vol. 1, Issue 1, 1988, pp. 1-24.
[9]Deng, J.L. Properties of relational space for Grey systems, *In essential topics on Grey system—theory and applications*, China Ocean, 1988. pp. 1-13.
[10] Zavadskas, E.K., Kaklauskas, A., Turskis, Z., Tamošaitienė, J. Selection of the effective dwelling house walls by applying attributes values determined at intervals, *Journal of civil engineering and management*, Vol. 14, No 2, 2008, pp. 85-93.
[11] *Edmundas Kazimieras Zavadska, Zenonas Turskis, Jolanta Tamosaitiene,Valerija Marina"selection of construction project managers by applying COPRAS-G method"* the 8th international conference "reliability and statistics in transportation and communication - 2008"