Implementation of a Model for Websites Quality Evaluation – DU Website

Kavindra Kumar Singh
Research Scholar
Faculty of Computer and System Sciences
Shri Venkateshwara University, UP
e-mail: singhkavindra@rediffmail.com
contact: +91-8559874775

Dr. Praveen Kumar
Professor
Bharat Institute of Technology
Meerut

Jitendra Mathur
Assistant Professor
School of Computer and System Sciences, Jaipur National University, Jaipur

ABSTRACT

The rapid growth of web applications increases the need to evaluate web applications quantitatively. In the past few years some valuable works like WebQEM (Web Quality Evaluation Method) tried to objectively evaluate the web applications. However, still weighting web attributes which is one step of evaluation of web applications is completely subjective, depending mostly on experts' judgments. In this paper, a quantitative evaluation strategy is discussed to access the quality of web sites and applications (WebApps). The methodology is useful to systematically assess characteristics, sub-characteristics and attributes that influence product quality. This paper analyze phases and activities, describes the produced deliverables, and present models, methods, procedures, principles and tools to apply in these activities. In addition, paper outlines the approach and its solutions, using a specific website for evaluation, and other carried out field studies. Finally, paper describes thoroughly an evaluation process.

Keywords: *Web attribute, Web quality, Attribute weighting, Web engineering, WebQEM.*

1. INTRODUCTION

Many people consider that quality of product or service is what the end-user or customer receives from it, not what the provider or seller put into it. Hence, a web site should try to satisfy its customer's needs to ensure repeat their visits, and achieve their loyalty. Therefore, it is important to understand the way of evaluating a web site quality.

In order to evaluate the quality of a web site, a number of attempts at evaluation of consumer-oriented web sites have been developed. Some were in a purely subjective form of individual preferences of the assessor, and some were in the objective form of statistical measurement, such as monitoring the download time of the site and site traffics.

Website Quality (or Quality of Websites) could be measured from two perspectives: Programmers, and End-users. The aspects of website quality from programmers focus on the degree of Maintainability, Security, Functionality, etc. Whilst the end-users are paying more attentions to Usability, Efficiency, Creditability, etc.

One of the primary goal for web site quantitative evaluation is to understand the extent which a given collection of quality characteristics fulfills a selected set of needs regarding a specific user view. On the one hand, web site domains like electronic commerce, museums, academic sites, etc., are becoming increasingly complex systems. Hence, an integral quantitative evaluation process regarding all relevant quality characteristics is also a complex issue. The evaluation complexity is caused by the large amount of intervening characteristics and attributes, and by the complex logic relationships among attributes and characteristics. Besides, some relevant attributes to evaluate cannot objectively be measured so that only can be included after a subjective measurement made by expert evaluators.

The main aim of this work is to show new methodology, utilized for the quantitative evaluation in the operational phase. The core evaluation models and procedures are grounded in the LSP model and continuous preference logic as mathematical background. Here, paper discusses the general process steps that evaluators should follow by applying Web-site QEM. So that, in order to specifically describe how to evaluate the Delhi University (DU) website step by step, the

website evaluation tool will calculate the five quality characteristics in the DU's root page. This university is internationally well-known and placed in New Delhi city in India.

Paper goal is to evaluate the level of accomplishment of required characteristic as aesthetic, ease of use, multimedia, rich content, and reputation, and computed overall evaluation to analyze and draw conclusions about the state of the art of web site quality. At the end of the evaluation and comparison process, paper obtains for each selected web site system a global quality indicator using the scale from 0 to 100%. Such cardinal rating will fall in three categories or preference levels, namely: *unsatisfactory* (from 0 to 40%), *marginal* (from 40 to 60%), and *satisfactory* (from 60 to 100%).

This paper is structured into different section as follows: *In section 2, present an existing quality model* that discuss almost all existing models that is being used to evaluate the quality websites. In Section 3, paper makes some *Elementary Measurement about the Website*. Paper represents *quality characteristics and attributes* regarding the general visitor standpoint and rating levels, in Section 4. Next, paper analyzes *overall evaluation* and calculations; and, finally, giving concluding remarks and future work.

2. Existing Quality Model

2.1 ISO Quality Model

The first model identifying quality within software was in the mid 1970's. The International Organization for Standardization (ISO) in cooperation with the International Electro-technical Commission (IEC) finished the development of the new standard "ISO 9126 - Information Technology – Software Product Evaluation – Quality characteristics and guidelines". It defined the quality model that can be applied to any kind of software product or service. In the process of standard revision, two series have been established: series ISO 9126 defined the quality model and series ISO 14598 described the quality evaluation process. This standard divided quality into six basic characteristics: functionality, usability, efficiency, reliability, maintainability and portability.

A subset of characteristics from the ISO model is part of the second level in the proposed model, where each characteristic is broken down into a set of sub-characteristics, which are in turn further broken down into a set of indicators at the third level. The choice of indicators is based on a set of web quality guidelines, W3C standards and the analysis of the existing websites.

Figure 1 is represents the hierarchy of the proposed model. Looking from the top, the quality of characteristics depends on the quality of its sub-characteristics, which in turn depend on the quality of their indicators. However, looking from the perspective of the indicator, the quality of each indicator influences the quality of the appropriate sub-characteristic, which in turn influences the quality of the appropriate characteristic in the quality model.
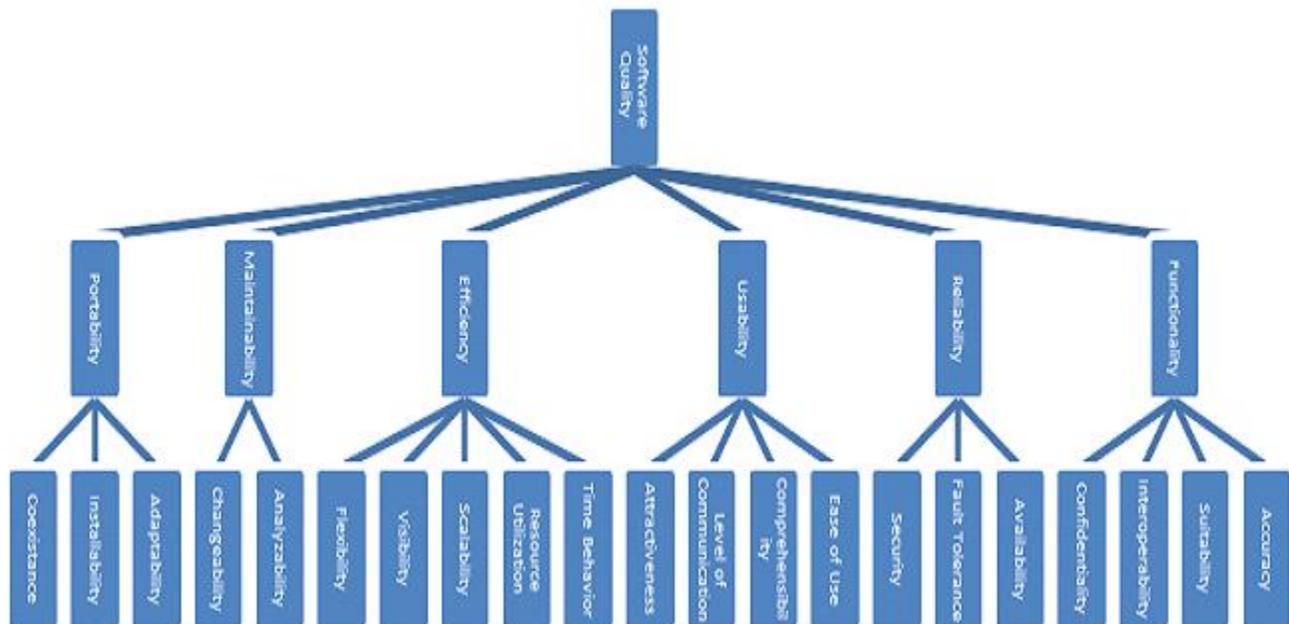
Figure 1: ISO Quality Model

2.2 Other Website Quality Models

- Nakwichian and Sunetnanta presented a user-centric web quality assessment model, which enabled them to evaluate website quality with respect to access by different end-user groups. They defined the common quality features as a guideline of website quality assessment. They designed a generalized assessment process that can be applied to diverse end-user domains. Their quality model is built on ISO/IEC 9126 and IEEE 1061 standards.

- Brajnik stated that the quality model has to be defined. He suggested the adoption of Goal-Question-Metric paradigm as a useful framework to guide the definition of the quality model.

- Fitzpatrick et al looked at quality models with Human Computer Interaction standards. They defined a general set of 12 external and 5 internal quality factors. External factors included suitability, installability, functionality, adaptability, ease-of-use, learnability, interoperability, reliability, safety, security, correctness and efficiency. Internal attributes included maintainability, testability, flexibility, reusability and portability. Fitzpatrick later identified an additional 5 web site-specific characteristics: visibility, intelligibility, credibility, engagibility and differentiation [14]. For each of the characteristics they defined a set of "enablers" that reflect the existence and importance of the characteristic in question.

- Offut analysed the quality attributes of web applications and identifies eight attributes: reliability, usability, security, availability, scalability, maintainability, performance and time-to-market.

- Olsina et al described a Quality Evaluation Model which according to the same high-level quality characteristics, outlined a quality requirement tree containing more than 100 characteristics that refer to different website domains, e-commerce, academic sites and provide a descriptive framework to specify these quality characteristics. This requirement tree is rooted on ISO 9126 standard.

While there are many different theories and methods which can be used for internal and external evaluation, however they do not have any model which covers all quality aspects especially communication aspects such as theoretical and specific aspects and even more important, aesthetic aspects. The field of websites design mainly focused on the technical and functional aspects of web design, but ignoring the lack of aesthetic and reputation aspects.

A point of departure in Lisbeth Thorlacius's visual, aesthetic communication model, she designed for use as a theoretical model in the construction and analysis of the visual and aesthetic aspects of all media products. The main communication factors, such as the context, the addresser, the addressee, the consistency and the medium within the visual communication, have been thought through. Just as described above, the quality model of a website is determined by the process of evaluation, design, implementation and validation involving a variety of methods and tools. In order to carry out on these processes, quality metrics need to be defined.

3. Elementary Measurement about Website

Primary, paper is trying to draw some general issues and assumptions to the present web site. One of the main goal for academic assessment is to understand the extent which a selected set of quality attributes fulfill a given set of stated requirements. Particularly, in this work paper focuses on the operational phase of web site. Figure 2 shows a snapshot of home pages.

Speaking in a wide sense, software artifacts are generally produced to satisfy specific user's needs, and Web-site artifacts are not the exception. In designing Web-site artifacts, there are many challenges that frequently are minimized. For instance, when users enter the first time at a given home page they often can figure to find a piece of information quickly. There are two mechanisms to help them in doing that: browsing and searching. Thus, to get a time-effective mental model of the overall site (that is, structure and content), there are attributes like a site map, an index, or a table of contents, that help in getting a quick global site understandability.

These attributes facilitate browsing. However, a global searching function provided in the main page could effectively help retrieving the desired piece of information and avoid browsing. Moreover, both functions could be complemented at any moment. There are many attributes and characteristics that contribute to site quality such as aesthetic, ease of use, multimedia among others; that a designer should take into account when designing for intended audiences.

Figure 2*. Delhi University - home page*

4. Quality Attributes Evaluation

In this step, define and categorize a wide set of academic quality attributes grouping them into a requirement tree. The primary goal is to group characteristics and attributes by performing the third step of the Web-site QEM. To follows well-known standards paper uses the same high-level characteristics like aesthetic, ease of use, multimedia, rich content, and reputation. These characteristics give evaluators a conceptual and general description of software quality and provide a baseline for further decomposition. From these characteristics, paper could derive sub-characteristics, and from these, study could specify measurable attributes and variables.

In addition, the relative importance of characteristics varies depending on the different users and application domains. According to this, paper defines three views of quality: visitor, developer, and manager views. Figure 3, outline the major characteristics and measurable attributes regarding the visitor standpoint. Specifically, from the point of view of general visitors, artifacts characteristics such as maintainability and portability will not be necessary to evaluate. General visitors are mainly interested in the ease of use and communicativeness of the Web site, in its browsing and search mechanisms, in its coherent navigation mechanisms and dependent-domain expected functionality, and also, in the site reliability and efficiency.

1 **Aesthetic Evaluation**
  1.1 *Images*
    1.1.1 Definite Image Size
    1.1.2 *One Larger Image in One Page*
    1.1.3 *Image ALT*
    1.1.4 *Image Link*
  1.2 *Page's Resolution & Resizable Table*
    1.2.1 Sizable Table
    1.2.2 Optimize the Page Resolution
  1.3 *Color*
    1.3.1 Using Multiple Colors
    1.3.2 Using Sage Color
    1.3.3 Limitations of Colors for Color Blindness People
  1.4 *Emphasis*
    1.4.1 Underline of Text
2 **Ease of Use**
  2.1 *Consistency*
    2.1.1 CSS Attributes
  2.2 *Navigation*
    2.2.1 Frames Validity
    2.2.2 Link to Home
    2.2.3 Navigation Menu Bar
  2.3 *Comment*
    2.3.1 Label of Link Table and Form
    2.3.2 Description of Meta
3 **Multimedia**
  3.1 *Plug-in Support*
  3.2 *Attributes of Multimedia Components*
  3.3 *One Media in One Page*
  3.4 *Using Thumbnails*
4 **Rich Content**
  4.1 *Bulletin Boards*
  4.2 *Information Guide*
  4.3 *Search Engine*
  4.4 *Avoiding Auto-refresh*
5 **Reputation**
  5.1 *Customer Feedback*
  5.2 *Web Traffic*
  5.3 *Domain Name*
  5.4 *Information Publicity*

Figure 3: Major characteristics and sub-characteristics

4.1 Aesthetic Evaluation

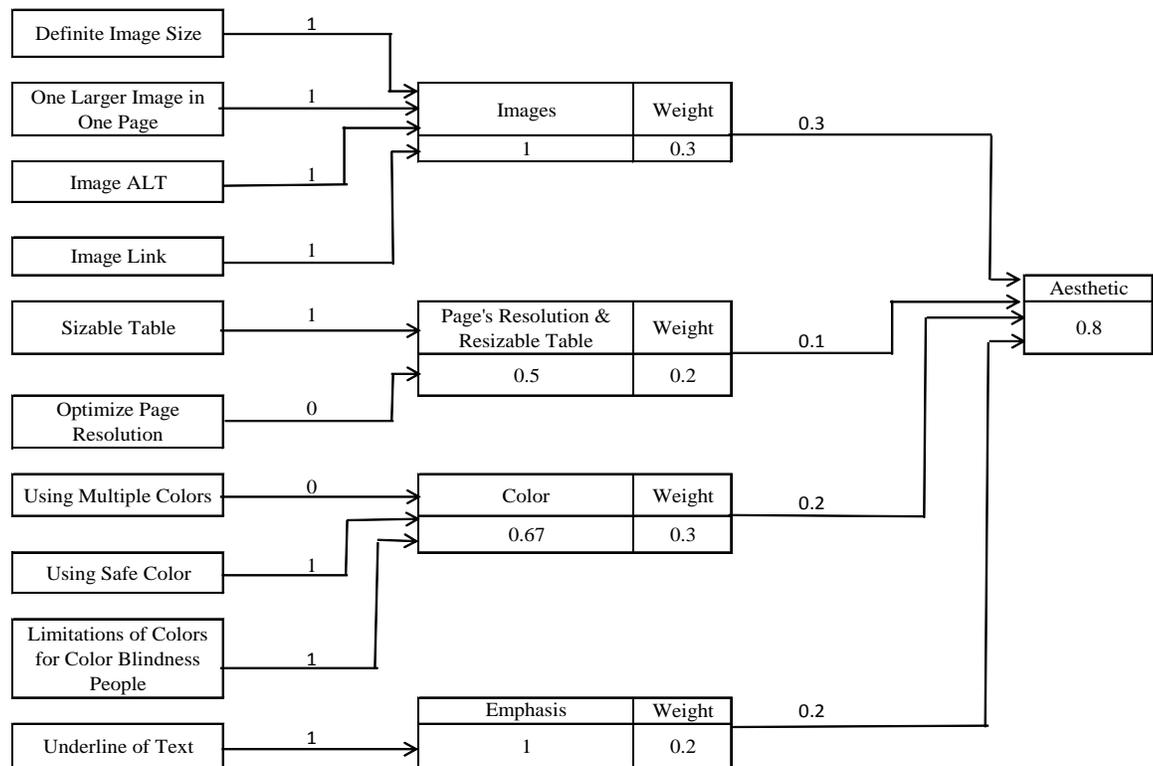The results of the aesthetic evaluation are shown in Figure 4.

Figure 4. Aesthetics characteristic for a root page of DU website in December, 2013.

In order to fairly evaluate the degree of aesthetics in a website, each sub-characteristic has to define the weight. Sub-characteristics in Images and Color attract more attention than others, they both weigh 0.3, Emphasis, Page's resolution and Standard Table Size each weigh the same at 0.2. According to the formula of evaluation and relative criteria, the final result of aesthetics is 0.8.

4.2 Ease of Use

Ease of use characteristic and its "children" sub-characteristics are both immeasurable factors as they have to calculate the measurable indicators through the formulae to evaluate their quality rate. For example, the ease of use characteristic from DU's root page has been evaluated by this metrics and shown in Figure 5.
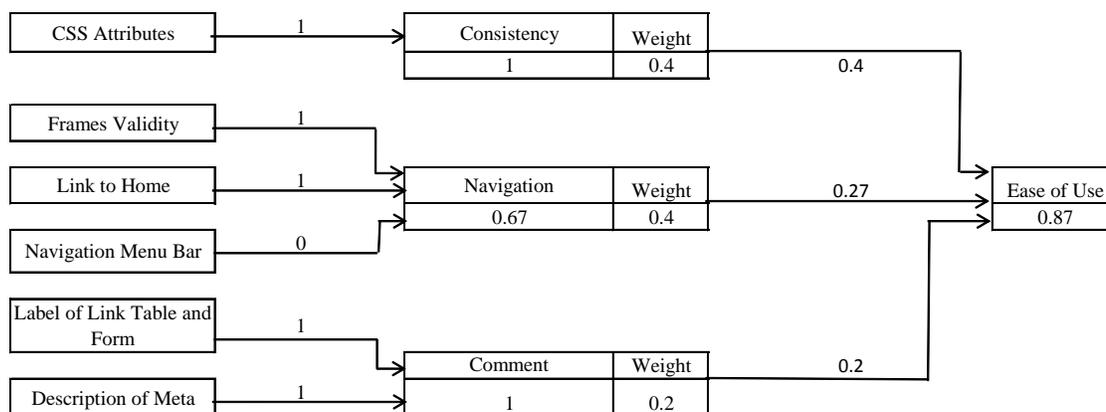
Figure 5. Ease of Use characteristic for a root page of DU website in December, 2013.

The results indicate the scoring for each measurable indicator, the rate of sub-characteristics and the final value for the ease of use characteristic. The evaluator can easily see the quality grade for each level. For instance, Consistency and Comment received full marks, Navigation needs improvement, and the satisfactory quality for ease of use is 0.87.

4.3 Multimedia Evaluation

Multimedia has the factors as they have to calculate the measurable indicators through the formulae to evaluate their quality rate. The DU website has been measured as an example below.
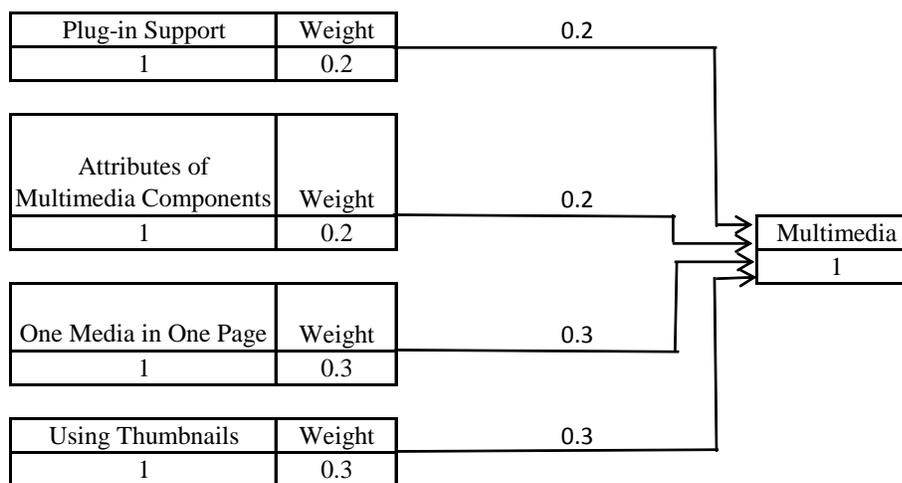

Figure 6. Multimedia characteristic for the main page of the DU website in December, 2013.

The evaluation of multimedia has been calculated in Figure 6, and shown every measurable indicator with into the excellent quality score. The final result of multimedia is 1, which means the quality of multimedia is excellent quality in the DU website.

4.4 Rich Content Evaluation

The evaluation process is carried on through an average formula to calculate the final scores and then the relative weights need to be computed. A root page from the DU website has been assessed as an example. Figure 7 shows the results of the content evaluation process. The quality of metrics classified in each value of indicator, and sum of these values shows greater quality in the DU website.
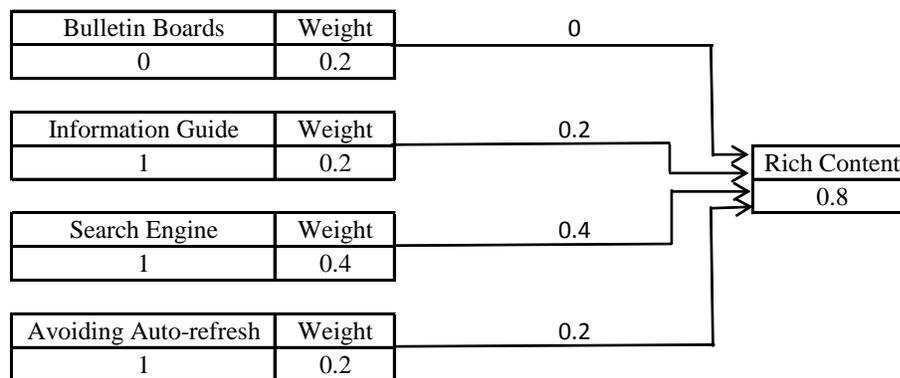

Figure 7. Rich Content characteristic for a root page of DU website in December, 2013.

4.5 Reputation Evaluation

An evaluation of reputation has been calculated by a particularly example in the DU website. The process of evaluation has been showed in Figure 8.
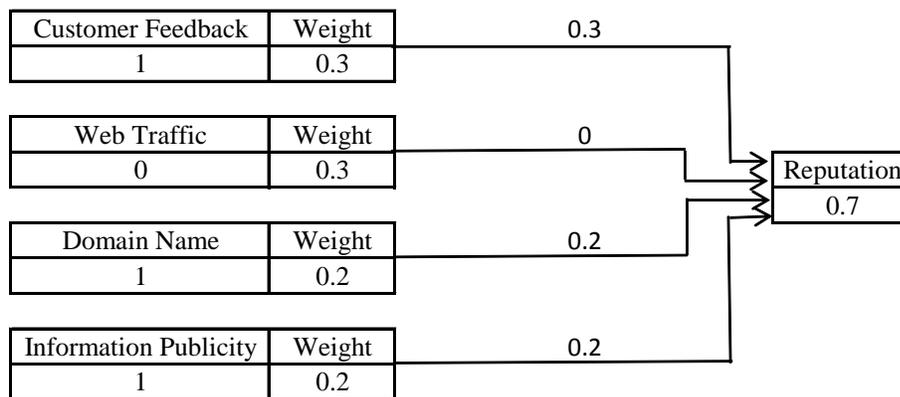

Figure 8. Reputation characteristic for the DU website in December, 2013.

The reputation metrics have taken a fairly calculated the scoring of each measurable indicator (criterion) by the meaning of the weights. This is an important feature needs to be paid more attention, because the DU's URL address has state abbreviation (.ac.in) in the end. The indicator of web feedback is valued as excellent quality 1 automatically according to the definition of web feedback criterion.

5. Overall Evaluation

According to the formulae, the five total quality characteristics are calculated. The results are shown in below:

Quality	Aesthetic (Weight=0.3)	Ease of Use (Weight=0.2)	Multimedia (Weight=0.1)	Rich Content (Weight=0.1)	Reputation (Weight=0.3)	Final Score
Delhi University (DU)	0.8	0.87	1	0.8	0.7	0.80

Table 1. Final rankings for each quality characteristics in the root page of DU website.

After the each quality characteristics have been calculated, it is clear that aesthetic 80% (i.e. 0.80 in decimal), ease of use 87% (i.e. 0.87 in decimal), multimedia 100% (i.e. 1 in decimal), rich content 80% (i.e. 0.80 in decimal), and reputation 70% (i.e. 0.70 in decimal) satisfies the user.

A formula is used by computing the final quality score of DU website.

$FinalWeb = 0.3 \times TotalAesthetics + 0.2 \times TotalEoU + 0.1 \times TotalMultimedia + 0.1 \times TotalRcontent + 0.3 \times TotalReputation$

According to this formula, the final quality score is: 0.80

$$\begin{aligned} \text{Final Score} &= 0.3 \times 0.8 + 0.2 \times 0.87 + 0.1 \times 1 + 0.1 \times 0.8 + 0.3 \times 0.7 \\ &= 0.24 + 0.17 + 0.1 + 0.08 + 0.21 \\ &= 0.80 \end{aligned}$$

Table 2. *Detailed results of quality preferences after computing the corresponding aggregated criteria function*

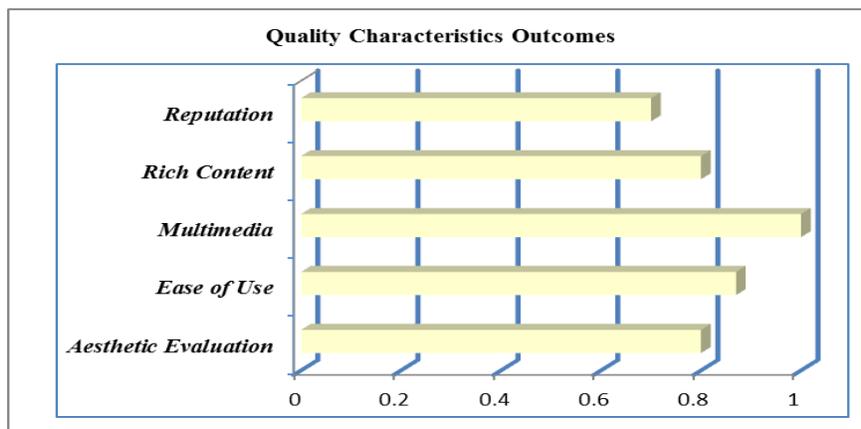| S.No.	Characteristics	DU (in decimal)	DU (in %)	Satisfaction Level
1	Aesthetic Evaluation	0.8	80%	Completely Satisfies
2	Ease of Use	0.87	87%	Completely Satisfies
3	Multimedia	1	100%	Completely Satisfies
4	Rich Content	0.8	80%	Completely Satisfies
5	Reputation	0.7	70%	Satisfies

Figure 9. *Graphical ranking of each quality attribute*

Considering the evaluation in the best and worst quality characteristics, the multimedia is highest quality characteristic and reputation is lowest characteristic. Using this method the user can see which quality characteristic need to improvement and which are satisfactory. In the end, a final quality score has been calculated, which shows the root page websites quality evaluation.

6. Conclusion

The importance of the web evaluation framework has been proposed by three-level structures, which are quality characteristics, quality sub-characteristics and measurable criteria (indicators). In the first level, the web evaluation framework proposed five quality characteristics which included Aesthetics, Ease of Use, Multimedia, Rich Content and Reputation. Aesthetics and Reputation are the main parts of this paper. The second level characteristic is broken down by several Sub-characteristics. Each Sub-characteristic is inherited from parental quality characteristics, however only Aesthetics and Ease of Use have Sub-characteristics, and others such as Multimedia, Rich Content and Reputation are directly divided into the third level – measurable indicators.

Last, the website quality metrics calculates the quality criteria through several evaluation formulae giving results with the meaningful quality scores. After the quality criteria have been analyzed, the average formulae are computed based on the aggregate of each quality criteria. The results will from 0 to 1, also the means of weights is considered in the evaluation process. Obviously, the root page is more important than others, so the calculation for the whole quality of the website is defined by the root page. The result is also from 0 to 1, 0 represents poor quality and 1 means excellent quality. The proposed website quality metrics can be used as a website evaluation framework to evaluate existing websites and allocate quality scores, but also can be help to improving website quality through re-engineering.

7. Future Work

Since websites are continually developing, although many end users are still using PCs or Macs as just choice, the new web applications are necessary for mobile devices that could result in changes to website design. In the future, the website quality metrics will be adjusted to adapt this new challenge.

In order to automatically evaluate the quality of a website by using a web evaluation tool, there are still several problems. For example, some defined quality criteria are not analyzed completely by the web evaluation tool, because most of websites are designed by many classes (object-oriented function). It is difficult to extract the HTML source codes from a website. On the other hand, currently website evaluation tool is a Windows application. In the future it should be run on-line.

Evaluating the quality of website topic itself is a continuous research topic that proposed an important issue and a software tool which focused on meeting the user's access expectations.

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