

A Study on Website Quality Models

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Abstract- The Purpose of this paper is to have an overview of various quality models to evaluate the usability of website. It focuses on quality characteristics, quality measurement and evaluation methods for a website. It also analyses about various web metrics which are used to assess the website performance. It also gives an insight about quality evaluation framework comprising quality measurement, characteristics, sub-characteristics and measurable indicators. It concludes with some of the limitations of quality evaluation methods.

Index Terms- Quality measurement, Quality Evaluation Framework, Website usability, Web metrics

I. INTRODUCTION

Many number of new websites have been launched every day. Ones with similar content will not have the same degree of quality. If the quality is poor, the user will simply leave the website and go elsewhere. Generally, there is no second chance to get a user back to the website. Therefore, in order to improve the quality of a website. The quality of a website makes a website profitable, user friendly and accessible, and it also offers useful and reliable information, providing good design and

visual appearance to meet the users' needs and expectations. This can be done by defining the measurable website criteria.

Website quality is dependent on the quality of the software. 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.

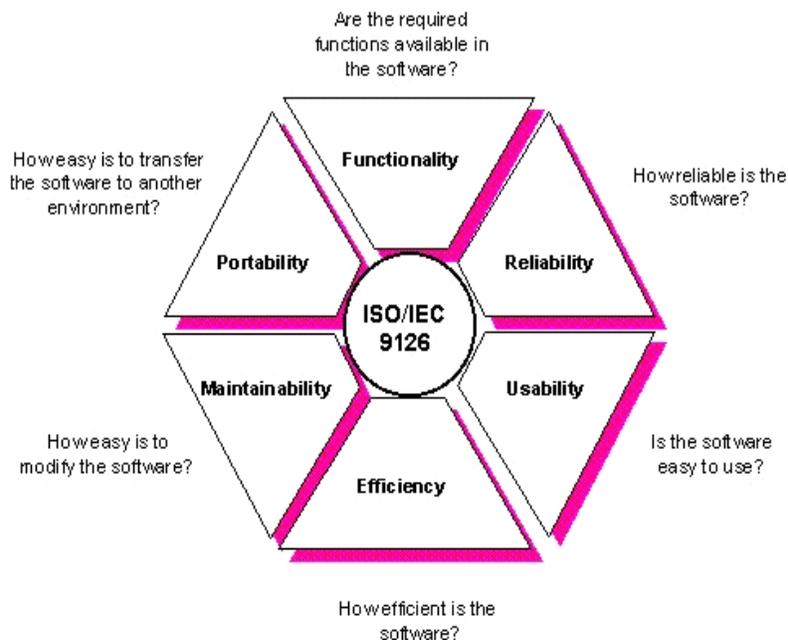
A website quality model shows an approach to the definition and measurement of website quality. It describes the trade-off between the user's needs to be well-established and flexible functions to permit the web application with diverse content.

II. QUALITY MODEL

A quality model (QM) is a "defined set of characteristics, and of relationships between them, which provides a framework for specifying quality requirements and evaluating quality."

Quality models for measuring website quality:

ISO Quality Model:



The first model identifying quality within software was in the mid 1970's. The International Organisation for Standardization (ISO) in cooperation with the International Electro-technical Commission (IEC) finished the development of the new standard "ISO 9126 - Information Technology –

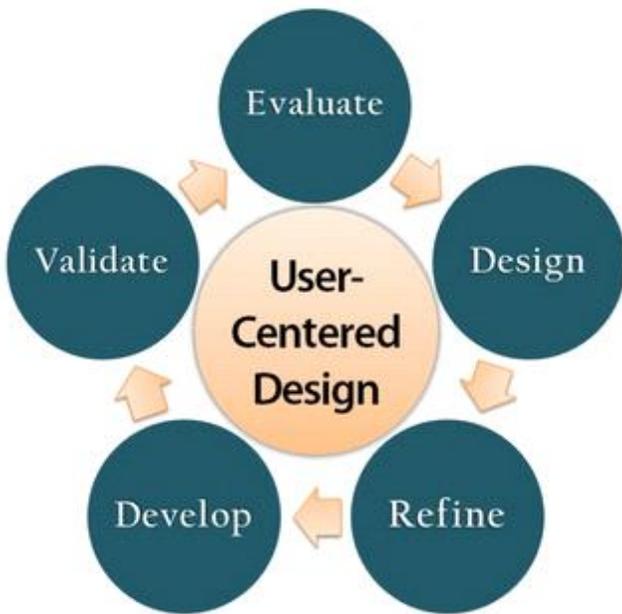
Software Product Evaluation – Quality characteristics and guidelines". It defined the quality model that can be applied to any kind of software product or service. In the process of standard revision, two series have been established: series ISO 9126 defined the quality model and series ISO 14598 described

the quality evaluation process. This standard divided quality into six basic characteristics: functionality, usability, efficiency, reliability, maintainability and portability.

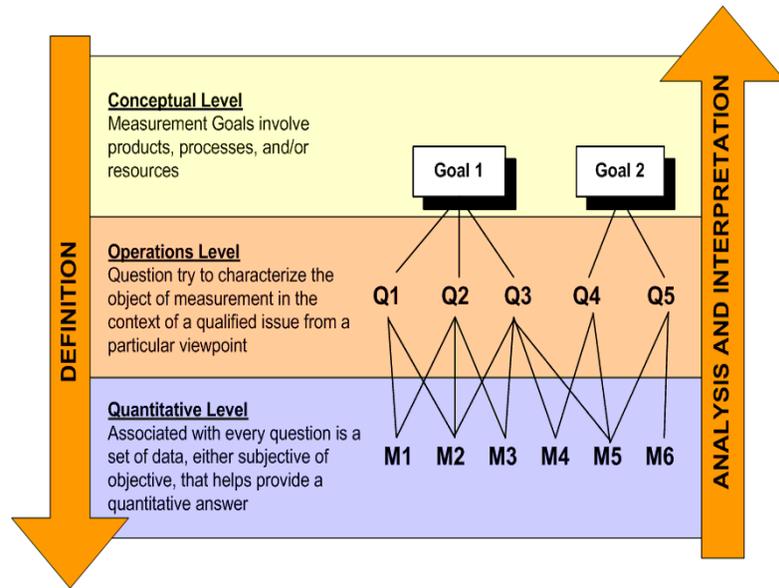
A subset of characteristics from the ISO model is part of the second level in the proposed model, where each characteristic is broken down into a set of sub-characteristics, which are in turn further broken down into a set of indicators at the third level. The choice of indicators is based on a set of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

Other Web 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.



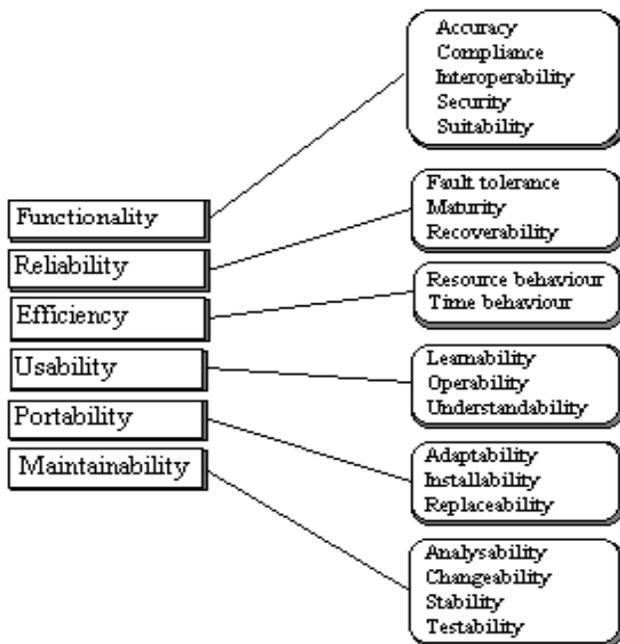
- Brajnik stated that the quality model has to be defined. He suggested the adoption of Goal-Question-Metric paradigm as a useful framework to guide the 9 definition of the quality model.



- 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, engagability and differentiation. 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.

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.

Websites Quality Metrics:

A website quality metrics is defined by a measurement method and the measurement scale. In order to evaluate the number of measurable physical or abstract attributes for understanding and optimizing websites usage.

Web metrics is like a visitor's journey once on the website. For example, the aesthetics characteristics will keep people on the website reputation characteristics increase people's trust, and encourage people to make a purchase. Website metrics assess a website in different domains which include e-commerce, academic, advertisement and so on. Each characteristic is compared against key performance indicators, and used to improve a website or marketing campaign's audience response. In Websites Quality Metrics, Lilburne et al proposed a Quality Compliance Framework (QCF) consisting of components such as quality measurement, quality characteristic, quality sub-characteristic and measurable indicator.

Quality Compliance Framework (QCF):

- Quality measurement is the quality achievement in terms of a percentage value that indicates the degree of an overall quality compliance of the system.

- Quality Characteristics are the high level quality factors of a web application. A quality characteristic may have many levels of quality sub-characteristics.

- Quality sub-characteristics are the lower level quality criteria that break down its parent characteristic to more measurable criteria.

- Quality indicators (criteria) are the measurable units of quality in QCF. A quality attribute may belong to one or many quality characteristics or quality sub-characteristics. QCF provides the quality measurement in a simple quality compliance scale. The scale starts from 0% and ends at 100%, where 0% indicates poor quality compliance and 100% indicates excellent quality compliance. This is the QCF score of the web application.

QCF works using bottom up approach. The metric for an attribute is converted to a 0% to 100% scale. Then the higher-level QCF score is calculated based on the QCF scores earned by the lower level children attributes, sub-characteristics, or indicators. Final score is the quality measurement. The following formulas show how the quality measurement is calculated for different components of QCF:

- Quality measurement

$$\text{Quality Measurement} = \frac{\sum \text{Children QCF}}{\text{No. of children}}$$

- Characteristics and sub-characteristics QCF score

$$\text{Quality Characteristic Score} = \frac{\sum \text{Children's QCF}}{\text{No. of children}}$$

- Attribute QCF score

$$\text{Quality indicator} = \left(\frac{\text{Earned Score}}{\text{Possible Score}} \right) \times 100\%$$

Here "Children" refers to the quality characteristics, quality sub-characteristics, or quality indicators in the hierarchy. It is worth remembering that the relative importance of some features changes depending on the specific purpose of the website, and also on the purpose of the page. Therefore, all the resulting values must be weighted.

III. QUALITY EVALUATION METHOD

Luis Olsina et al proposed a quantitative evaluation approach to assess the quality of websites called Website Quality Evaluation Method (QEM). In order to evaluate, compare, and rank the quality of Websites, Luis Olsina applies a set of activities regarding the proposed methodology. A high-level view of major phases and procedures required for quality assessment is shown below:

- The specification of goals and the user standpoint. The evaluators should define and refine the goals and scope of the evaluation process. They could evaluate a web development project or a web application, and could assess the quality of a set of characteristics of a component, a whole product, or compare characteristics and global preferences of selected ones.

- The definition of website quality requirements. The evaluators should agree and specify the quality characteristics and quality criteria, grouping them in a requirement tree.

- The definition of elementary criteria and measurement procedures (also called the determination of the elementary quality preference).

The evaluators should define the basis for elementary evaluation criteria and perform the measurement and rating process.

- The aggregation of elementary preferences to yield the global quality preferences. The evaluators should make decisions

that prepare and perform the evaluation process to obtain a global preference indicator for each selected website.

- The analysis, the assessing, and comparison of partial and global quality preferences. The evaluators assess and compare elementary, partial and global quantitative results regarding the established goals and user standpoint.

This approach is valuable for general web quality metrics. However, it also has limitations. Because evaluating a website through website QEM firstly requires a quality requirement tree that is created by a specific assessor who has professional skills. Website QEM has to relocate in a different domain (e.g. e-commerce, academic). For this reason, people are looking for an automatic evaluation tool that can measure a website easily. The evaluation needs efficiency and be simple according to the most common quality indicators, for example the user can type a web address and then click a button; the result will appear in the user's interface.

Web Sites Peculiarities:

The ISO standard provides a very general conceptual framework for defining QMs for complex systems with a substantial software component. The basic approach of defining a hierarchy of quality characteristics, and measurable properties which can be aggregated to obtain a quantitative measure of characteristics provides a sound foundation for defining any QM, in any domain. Moreover, the ISO model is the result of two decades of discussions about the basic quality dimensions of softwarebased systems. Its categorization and terminology can be discussed and - in a few cases - may also be considered somehow obscure, but certainly cannot be ignored in any approach to quality in software engineering.

On the other hand, it should be clearly understood that the ISO documents only provide a conceptual framework, and not a ready-to-use QM. To be of practical use, this framework must be tailored to the specific [class of] system[s] under consideration. This may not be a simple task, especially when these systems do not fit well with the systems considered in classical software engineering, such as ERP, command & control, embedded systems. This is the case of Web sites, which possess a number of peculiarities that greatly differentiate them from the above systems:

Information content: In the large majority of cases, unstructured information content prevails on structured data. Emphasis is on user navigation, not on data management and algorithmic computation. Therefore, a fundamental dimension of quality relates to information architecture. Information architects are more and more involved in large Web sites, together with content editors, who create and manage its information content. Information-rich sites may employ large editing staffs, with an organization in some ways similar to that of traditional magazines.

Communication: In most cases, Web sites can be considered machines whose main purpose is communication, rather than computing and data management. This is also true for e-commerce or other sites offering online services. Web sites address a global audience, in a strongly competitive, "open" environment. There is no user lock-in: competition is only a few clicks away, so visitors' loyalty must be won on a day-by-day basis. User attention span can be extremely short, so his/her

interest must be captured in brief time-intervals. So big efforts are required on communication and branding, and professionals typically not seen in traditional software projects are necessary (visual designers, art directors, communication experts).

Continuous evolution: Web sites are living organisms. Their contents are constantly updated, and even their information architecture changes frequently. This is true for any site, not only for information portals. Visitors of a site often expect the content to be updated practically in real time. Site managers must strive hard to comply with these expectations, just to keep their site reputation. Interactive services and the user interface are frequently modified and improved. According to the perpetual- β concept, the software behind these services is continuously modified to better serve user needs. These - in turn - change as new possibilities are discovered, in a constant co-evolution of usage patterns and system functions. In a word, managing the evolution of a Web site sets pressing requirements to site administrators, and this should be taken into account seriously in any QM designed for these systems.

IV. LIMITATIONS OF EXISTING WEB EVALUATION METHODS

In order to create a new website quality evaluation method effectively, some limitation has to be considered according to existing website evaluation methods.

- Today web-based application is complex. Many of existing website evaluation methods evaluates a website's quality based on its domains (e.g. e-commerce, education, entertainment, etc). It is necessary to create a comprehensive website evaluation method that is applicable to all the websites. According to a standard ISO quality model, a comprehensive website evaluation method is required to address common quality elements of the web application, since the elements vary for different kinds of websites.

- A number of existing website evaluation methods generally requires the evaluator who has IT background to assess the qualities in a website. It is difficult to apply if the people do not have any IT skills. An easily used interface and auto-evaluation are necessary in new website evaluation methods.

- Many new website software technologies and rules are not considered in existing website quality evaluation methods. The web developer is confused by the overall picture of the evaluation criteria. A new website evaluation methods need to involve the all identified new software technologies as the numbers of new criteria.

- The specific quality criteria for a website's reputation are clarified in many existing website evaluation methods, however most creditable criteria are immeasurable. The measurable creditable criteria need to be defined in a comprehensive web evaluation method (e.g. customer feedback, traffic, etc).

- In the end, the strengths and weaknesses of the web evaluation results should be applied to the user's expectations, and ease of understanding.

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