

Web-Based Applications quality factors: A survey and a proposed conceptual model

Arekatla Madhava Reddy, Nagam Aanjaneyulu, Butukuru Rojalakshmi, Mr. Merugu Anand Kumar

^{1,3} Assistant Professor, ^{2,4} Associate Professor

amreddy2008@gmail.com, anji.amrexamcell@gmail.com

brojalakshmi@gmail.com, meruguanand502@gmail.com

Department of CSE, A.M. Reddy Memorial College of Engineering and Technology, Petlurivaripalem,

Narasaraopet, Andhra Pradesh -522601

Abstract

Web-based applications (WBA) are rapidly growing in popularity, size, interactivity, and importance to the worldwide usage of computers. The most successful WBA firms are starting to understand that there are a few crucial variables that will determine whether or not their WBA succeeds or fails. Consistent in providing a top-notch website results. A methodology that categorizes and identifies WBA quality viewpoints is proposed as a means to the end of producing high-quality WBA. In this work, we discuss the WBA quality model and classify the many aspects of its quality. The program is a crucial component of any WBA. The primary goal of software quality assessment, as stated in the ISO9126 standard for software engineering product quality, is to provide a credible, transparent, and generally-accepted quantitative reference for the evaluation of software products. The absence of a clear characterization of critical elements for WBA quality is the major area of weakness. The additional features of WBA provide unique challenges, and conventional quality approaches just aren't up to the task.

1. Introduction

The World Wide Web (WWW) has developed into its own special place and is now one of our primary means of dissemination of knowledge and exchange of ideas. There is a plethora of data available on the internet. Web-based application (WBA) developers have a unique difficulty due to the wide variety of devices, operating systems, and browsers their users use. [1]. It's hardly unexpected that high-quality WBA development has attracted attention, given the scale and volatility of recent WBA advancements. WBA are more involved than standard HTML web pages since their development takes into account

several perspectives. WBA quality is notoriously hard to pin down and catalog. WBA are obviously more crucial. The question that remains unanswered is, "What factors reflect WBA quality?" How do we ensure the quality of WBA development? [2, 3]. This research proposes a conceptual paradigm to identify and classify WBA quality aspects. The proposed methodology uses many different perspectives and applications of WBA to systematically identify Quality factors and its sub factors. The core concept of the suggested model is split into two categories: One, to examine and ideally improve upon existing standards for WBA. Create a conceptual quality model that classifies and categorizes various perspectives and applications of quality in the WBA.

2. Theoretical background

The previous ten years have seen a significant deal of progress made in the field of WBA quality. The importance of evaluating attributes using WBA quality rises in tandem with increasing reliance on WBA. While the importance of WBA is well acknowledged, the majority of the available empirical research on the topic is exploratory in character (many of the studies were recommended before the widespread use of the internet and so tend to emphasize more conventional forms of data processing and information retrieval). Most recent research has focused either on a small subset of quality criteria or on narrowly defined WBA vantage points. There has been an uptick in recent years in the number of studies conducted as well as the variety of methods used to assess WBA's quality. The extended ISO model was selected as the baseline for our research because of its widespread adoption and use in the software industry. Important aspects of WBA's quality were isolated by analyzing its software quality traits. This section includes a short overview of popular software quality models, as well as

previously established quality models and variables in WBA that would serve as the foundation for a proposed conceptual model that accounts for various interpretations and applications of quality in WBA.

Software quality models

Since the 1970s, academics and industry professionals have sought to define software quality. They discovered that software artifacts might be broken down into separate constructs. Be calm and deliberate. As a result, we can now access quality by looking at it in more depth [4]. There has been a substantial amount of high-quality models exhibited. To begin, one of the first well-known quality models targeted system developers and the system development process; McCall et al.'s (1977) quality model [5]. By emphasizing certain software quality factors that are reflective of both the users' perspectives and the goals of the developers, McCall et al. (1977) aim to bridge the gap between the two groups. The three main viewpoints of the McCall quality model for defining and detecting software product quality are product revision, product transition, and product operation. The model also includes a hierarchy of elements, criteria, and measurements that elaborate on the three views. Each quality criteria is associated with one or more quality factors, which characterize various forms of system behavior. In turn, the quality metric is supposed to capture various components of a quality standard. ISO/IEC 9126/2001 [6] is the standard that defines software quality, and it does so by describing a so-called software quality model that links internal and external software characteristics to properties of software. (SQM). ISO 9126's definition of quality software is based on McCall's factor-criteria-metrics model. (1977). It specifies six quality parameters that might be used as criterion. Metrics evaluating the design and development process and the program itself are used to evaluate these criteria.

WBA quality models

The widespread use of WBA has made it an essential component of modern computing.

Table 1 Six quality characteristics of ISO9126.

Functionality	Shows the existence of a set of functions and their specified properties. The functions satisfy stated or implied needs
Reliability	That capability of software which maintains its level of performance under given conditions for a given period of time
Usability	Attributes that determine the effort needed for use and the assessment of such use by a set of users
Efficiency	The relationship between the level of performance of the software and the amount of resources used under stated conditions
Maintainability	The effort needed to make specified modifications
Portability	The ability of the software to be transformed from one environment to another

Applications. WBA software is advanced, dynamic, and often updated. Since 1994, many WBA quality models have been developed to evaluate different aspects of WBA quality. Which I will elaborate on below: To verify that the list of quality characteristics is exhaustive, further study was conducted. E-commerce website software is huge and complicated, yet quality standards need the critical performance of aspects like availability, performance, scalability, and security. This is why scalability and availability were introduced. Ultimately, this has the most impact on the successful application of any WBA. A large number of software quality traits were categorized by Albuquerque and Belchior [8] in 2002 into goals, with each goal consisting of many quality criteria. Each quality component is broken down into even more specific criteria. Three overarching goals are proposed by Albuquerque and Belchior to assess the quality of an E-commerce WBA. In 2002, Eppler and Muenzenmayer [9-13] suggested a quality model for WAB content. When discussing the variables that contribute to the quality of WBA, content quality is crucial. The quality of content is often seen as a multi-faceted notion with several facets. Quality in WBA was broken down by Pepper's approach into two categories: content quality and media quality. The quality of the content is divided in half. (Relevant information and sound information). There are scales for every class. There were notable methodological and practical differences across the aforementioned content quality model frameworks. Nonetheless, they have many similarities.

3. Proposed WBA model development

As a rapidly developing sector of the software industry, Web-Based Applications (WBA) provide a fresh approach to deploying programs. Construction WBAs include high-quality; interactive apps are being built using a wide range of cutting-edge programming languages, tools, and methodologies. Software implementations of WBA are possible. However, there are new characteristics of WBA that come with their own set of challenges. This means that conventional approaches to measuring software quality cannot cover all aspects of WBA. ISO/IEC9126 (2001) for software quality model served as inspiration for the suggested conceptual quality model for WBA [4, 6].

Structure of WBA quality model (WBAQM)

Dromey's generic quality framework [16] offers a bottom-up approach to the creation of quality models. It was based on breaking down high-quality components. Qualities into observable, quantitative characteristics of software product features. Dromey's generic quality model consists of three basic components: a collection of high-level quality criteria, a means of connecting them, and product properties that impact quality. The same bottom-up approach is used in the WBA Quality Model (WBAQM), which employs ISO 9126 quality frameworks to define a variety of WBA quality factors and sub factors. Then, it makes an effort to connect the dots between all of the many facets of quality. Figure 1 displays the tiers that make up this model: [5] WBA quality views and usages are identified in the first layer.

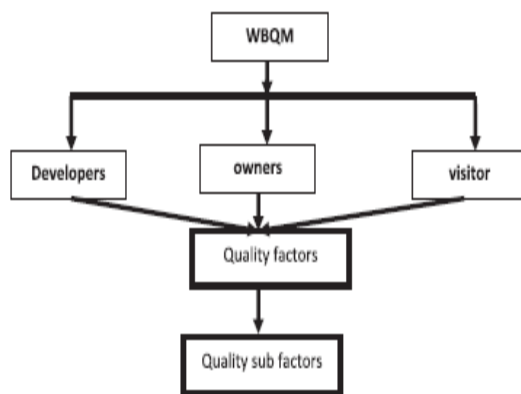


Figure 1 WBAQM structure.

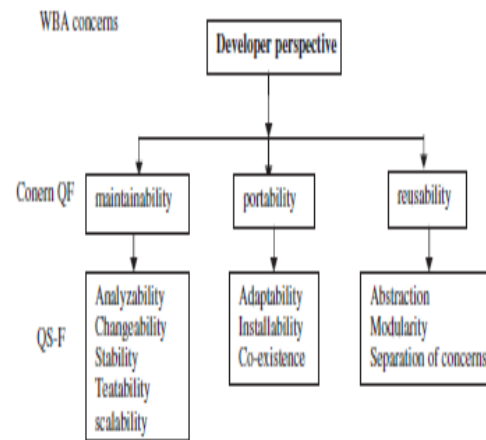


Figure 2: Developer-perceived quality factors and sub factors.

Step Two: Classifying Quality Elements According to Each Quality Perspective Third layer: assigning granularity levels to individual quality indicators. In the sections that follow, we'll go into detail about each of these tiers.

Identifying WBA Perspectives (Layer 1)

Quality is "the totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs," as defined by the International Organization for Standardization (ISO). The goals of WBA should be kept in mind when analyzing its quality standards. Evaluation of quality is often conducted in-house using criteria developed by the owner firm in light of its own objectives. The demands of WBA's users, which may vary from those of the owning firm, should be taken into consideration for a more complete assessment of the platform. Keep in mind that WBA differs from conventional information systems because to the hypermedia nature of the Internet and the significance of issues relating to interfaces, information access speed, and transaction security. Additionally, designers of WBAs bring a variety of expertise to the table. WBA quality may be profoundly affected by the diversity of the people that contribute to its creation. WBA developers, who are usually in charge of WBA development initiatives, may not be familiar with the technical factors that influence WBA's performance. There is a wide variety of features that "need to include," are "easy to find," "easy to download," and "easy to understand" from the user's (visitor's) point of view. Users must have faith in WBA's contents and the aims of the owner firm application. WBA should be user-friendly and provide comprehensive navigational assistance. From the viewpoint of the owner firm, WBA is meant to portray a certain image

and message, guide visitors around the company's web applications, and provide easy access to relevant information and expertise. WBA's goals diverge from those of more conventional apps, which often aim to process data. As a result, WBA has varying standards of quality.

In the parts that follow, I'll elaborate on each of these points of view. Troubles with the coders. Interactions with a company's website, for example, are one example of the many ways in which businesses communicate with their clients. Media use on all sides. A web-based interface is a great option for communicating with clients because of its many useful features. The most important challenge facing every WBA developer is integrating the demands of visitors and owner promotion with a wide range of quality features [9, 10, 17, and 18].

Table 2 Quality subfactors of developer perspective.

Quality factor	Quality subfactor	Description
Portability	Adaptability	The extent to which WBA can be adapted for different specified environment
	Installability	The extent to which WBA can be easily installed in a specific environment
	Co-existence	The extent to which WBA can co-exist with other independent software in a common environment sharing common resources
Maintainability	Analyzability	The extent to which WBA can be diagnosed for deficiencies or causes of failures and identify the parts which must be modified
	Changeability	The extent to which the specified modifications can be implemented. Stability refers to avoid unexpected effects from modifications
	Testability	The extent to which the implemented modifications can be validated
	Scalability	The extent to which WBA can be easily and efficiently expanded to meet specific needs and situations
Reusability	Abstract action	The act of representing essential concepts away from low level and unimportant details
	Modularity	Divide WBA into modules or components then integrate them to produce the whole system
	Separation of concerns	The capability to separate among concerns such as separating navigational elements from data and separating presentation from structure

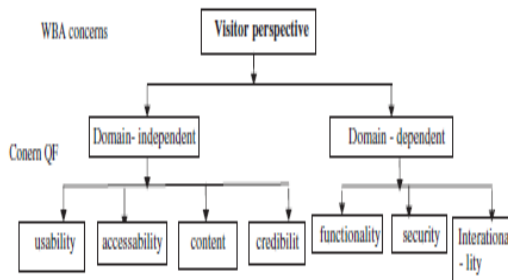


Figure 3: Viewer viewpoint quality parameters.

Things that bother the owner. As their markets have grown more global and service oriented, many companies have the use of WBA. Potential advantages for businesses from WBA include lower transaction costs, shorter transaction times, fewer clerical errors, quicker reactions to emerging market opportunities, better tracking of customers' preferences, enhanced market intelligence, faster information dissemination to stakeholders, and more targeted marketing and advertising [9,12,15,20]. We determined that the owner of the Firm's WBA is primarily concerned with three quality factors:

distinctiveness, popularity, and profitability, based on our review of the relevant literature on web quality models.

Second-Level Categorization: Quality Perspective

The proposed WBAQM's first set of quality characteristics is comprised of those found in ISO 9126: functionality, dependability, efficiency, use, maintainability, and portability. We examined each of these elements separately to see whether they had any impact on WBA's character and to see if this group was sufficiently comprehensive to cover all of the quality facets of the WBA quality model. In the first place, developers' viewpoints were connected to some of the ISO quality characteristics including maintainability and portability [6]. For instance, WBA's maintainability talks about how readily it may be updated as time goes forward. It encompasses any efforts done in the directions of repair, adaptation, perfection, and prevention. To the program while it is running in order to fulfill or enhance certain needs. It's a major criterion for evaluating a developer's competence. The approach of construction is shown in part via features such as portability.

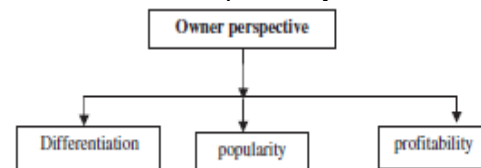


Figure 4: Indicators of Owner Quality.

WBA to function in a certain ecosystem or with a given set of hardware, but it can be optimized with little effort to function in any differences in hardware or setting. As a result, it was chosen to include portability as a developer-focused quality factor [21, 22]. The ability to apply a WBA to a different issue with little or no additional work is a hallmark of its reusability. Therefore, in Fig. 2 and Table 2, we see the first group of quality elements and sub factors from the developer's viewpoint, which are: portability, maintainability, and reusability. It is possible to identify the qualities that employers value in developers by looking at this list. Second, the visitor's point of view may be broken down into both universal and specific measures of excellence. Usability, accessibility, content quality, and credibility are the four pillars of the Web Quality Assessment (WQA) that are universal across all WBA domains. However, domain-dependent quality variables stand for quality concerns that vary greatly

depending on the context. Safety, usefulness, and adaptability to different contexts are all indicators of its high quality. Figure 3 and Table 3 both depict quality aspects from the viewpoint of visitors [23, 24]. Finally, from the owner's point of view, the most important aspects of quality are uniqueness, popularity, and return on investment. Quality parameters from the viewpoint of the owner are shown in Fig. 4 and Table 5. The quality criteria that have been given are not exhaustive, and thus may be simply altered to reflect a variety of intended purposes.

Table 3 Quality factors of visitor perspective.

Visitor perspective	Quality factor	Description
Domain independent	Accessibility	The extent to which WBA is easy and quickly findable and available for most internet user groups
	Content	The extent to which the offered information is accurate, consistent, suitable to visitor's needs and evoke his/her interest, and current
	Credibility	The extent to which web visitors confident with the owner of the application and with the presented content
	Usability	The extent in which WBA can be easily used
Domain dependent	Security	The extent to which the data/information/processes are protected so that unauthorized persons/ systems cannot read/modify them and authorized persons/systems are not denied access to them
	Functionality	The extent to which WBA provide an appropriate set of functions for specified tasks and provide a suitable content in terms of the amount and relevancy
	Internationalization	The extent to which the designing WBA so that it can be adapted to various languages and regions

Third layer: relating WBA quality indicators

The third phase of the WBA quality model under consideration involves the provision of quality sub components. WBA quality sub factors go beyond ISO 9126 software quality sub characteristics, which were also identified. Due to WBA's unique characteristics, a new group of quality sub factors is proposed. For instance, the amount to which WBA is simple to use is a crucial problem of visitor-perspective quality characteristics. The seven quality sub-factors that make up WBA usability are readability, navigation, searching, consistency, legibility, audio, and simplicity. The readability of a WBA site is a measure of how easily its users can absorb and make sense of its layout and content. The ease with which one may move about WBA is also a reflection of its navigability. A full complement of navigational aids should be supported by WBA to help users go to any portion of the application, to other applications, and to more of the information they need [25, 26]. Table 5 provides a comprehensive explanation of quality sub factors from a WBA viewpoint, and Tables 2 and 4 explain how these definitions connect to quality factors.

4. Conclusion

In conclusion, this work has identified the key quality elements and its sub aspects that measure the quality of WBA based on WBA perspectives and usages. To

begin, this Based on the research conducted, a conceptual model was proposed to classify WBA perspectives into the following categories: visitor, owner, and developer. Second, we'll classify the quality elements and sub factors of WBA that mirror these perspectives. The suggested model examined the similarities between WBA and software using the ISO 9126 quality factors and sub factors, and then presented a new set of WBA quality factors tailored to the industry. Future work will include expanding the model with experimental research and a validation methodology to back up the model's claims on the elements and sub factors that contribute to WBA quality.

References

- [1] Moshe Z, Chanan G, Itay A. User satisfaction from commercial web sites: the effect of design and use. *Inform Manage* 2006;43:157–78.
- [2] Chen YS, Robert M. Web-based interaction: a review of three important human factors. *Int J Inform Manage* 2010;30:379–87.
- [3] Solomon N, Terry R, Magid I. Quality and effectiveness in Webbased customer support systems. *Inform Manage* 2003;40: 757–68.
- [4] Eldesouky IA, Hesham A, Hazem R. Toward complex academic websites quality evaluation method (QEM) framework: quality requirements phase definition and specification. Cairo, Egypt: Mansoura University, Faculty of Engineering, Computer and Systems Engineering Department; 2008.
- [5] ELKorany A, Nabil D, ELDin AS. Quality measurement model for KADS domain knowledge. *J Softw Eng* 2009;1–14.
- [6] ISO/IEC TR 9126-3. Software engineering – product quality – Part3: internal metrics. International Organization for Standardization; 2003.
- [7] Suh W, Jongho K, Heeseok L. A benchmarking-based requirement analysis methodology for improving web sites. *Int J Electron Comm* 2009;13(3):119–62.
- [8] Albuquerque AB, Belchior AD. E-commerce websites: a qualitative evaluation. In: 11th international WWW conference proceedings. Hawaii: ACM Press; 2002. p. 294–300.
- [9] Beg MMS. A subjective measure of web search quality. *Inform Sci* 2005;169:365–81.
- [10] Shirleen K, Burn J. Developing a framework for assessing information quality on the World Wide Web. *Inform Sci J* 2005;8:159–72.