A practical approach to the assessment of quality in use of corporate web sites

Daniela Fogli*, Giovanni Guida [1]

Dipartimento di Ingegneria dell'Informazione, Università degli Studi di Brescia, Via Branze 38, 25123 Brescia, Italy

ABSTRACT

The paper presents a practical approach to web site quality, based on a novel perspective that considers the relationships between the web site and its stakeholders. This perspective leads to identify four fundamental concepts of quality: final quality, quality in use, basic quality and internal quality. This paper focuses on quality in use, and proposes a new quality model including a well structured and balanced set of characteristics and sub-characteristics, which aim at capturing the main dimensions that impact on the quality of a web site. The distinction between actual and expected quality is then introduced and a practical assessment methodology for expected quality (EQ-EVAL) is proposed, which employs expert evaluators instead of actual users in order to make the evaluation less expensive, without sacrificing, however, accuracy and reliability. The results of the application of the methodology in the evaluation of a sample set of corporate web sites are finally discussed, showing how the model and the methodology can indeed meet the stated requirements.

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1. Introduction

Web sites are more and more pervasive in today world and play a crucial role for success of a large variety of organizations in a variety of activity sectors including not only industry and commerce, but also government administrations, financial services, health-care, entertainment, culture and many others. These web sites are called **corporate web sites**, since all of them share a common scope and goal: supporting and promoting the activities of an organization with economic, cultural or social goals (Adams and Frost, 2004; Campbell and Beck, 2004). This definition excludes, however, other specific types of web sites, like search engines, social networks, gaming web sites, wikis, blogs, and online journals, just to name a few. Corporate web sites have acquired through the past fifteen years a progressively stronger role: from a simple window on the company, to a tool for supporting basic company functions online (such as customer relationships, brand image, or direct commerce), to a functional component of the business in charge of specific tasks that can only be carried out online. However, many of such web sites fail to meet expectations: users' needs are not satisfied at the expected degree and web site owners do not obtain adequate return on their investment. A web site that fails to contribute to the business is often useless, if not even harmful.

Poor effectiveness of a web site can be related to its poor quality, or, equivalently, quality is the attribute of a web site that accounts for its success (Offutt, 2002; Lee and Kozar, 2006). Low quality is responsible for dissatisfaction and poor utility for the users, and waste of resources and loss of opportunities for the web site owner.

Moreover, low quality is often difficult to identify, to diagnose and to recover. Therefore, the assessment of a web site quality is an important activity all during its life cycle. Assessment should be carried out during the design and development phases in order to early identify emerging problems and to correct them when recovery is simpler and less costly. But quality should also be monitored all during the operation phase of a web site, in order to guarantee its coherence with the owner's goals and to support continuous improvement.

According to the above discussion, in this paper we face two fundamental issues, namely (i) the definition of a *quality model* specifically tailored for corporate web sites, and (ii) the design of an *assessment methodology* supporting the effective and efficient application of the model in real cases.

A preliminary version of both the model and the methodology has been presented in Fogli and Guida (2013); this paper provides a much extended and re-elaborated version of the approach, along with the demonstration of its applicability.

In particular, the paper is organized as follows. Section 2 presents a critical survey of related works. Section 3 introduces

* Corresponding author. Tel.: +39 030 3715666; fax: +39 030 380014.
 E-mail addresses: daniela.fogli@unibs.it, daniela.fogli@gmail.com (D. Fogli), giovanni.guida@unibs.it (G. Guida).
 [1] Tel.: +39 030 3715454; fax: +39 030 380014.

a novel perspective on the concept of quality, based on the consideration of the stakeholders of a web site; this leads to the identification of four faces of quality, namely final quality, quality in use, basic quality, and internal quality. Section 4 presents a model for basic quality (QM-B), while Section 5 focuses on quality in use and proposes a new quality model (QM-U) that includes a well-structured and balanced set of characteristics and sub-characteristics aimed at capturing the main dimensions that have an impact on the quality of a web site. In Section 6, the distinction between actual and expected quality is then introduced and a practical assessment methodology for expected quality (EQ-EVAL) is proposed, which employs expert evaluators instead of actual users, in order to make the evaluation less expensive, without giving up, however, reliability and precision. In Section 7 the results of an application of the methodology in the evaluation of corporate web sites are discussed, showing how the methodology can indeed meet stated requirements. Finally, Section 8 provides some comparison with related works and outlines directions for future research.

2. Background and motivation

2.1. Related works

ISO 8402 defines 'quality' as "the set of characteristics of an entity that give that entity the ability to satisfy expressed and implicit needs" (ISO 8402, 1994). A similar concept is later assumed also in ISO 9000 that defines quality as "the ability of a set of intrinsic characteristics to satisfy requirements" (ISO 9000, 2005). In the specific case of software products, the standard ISO/IEC 9126 (ISO 9126, 2001) distinguishes between *internal* and *external qualities*, while its more recent version ISO/IEC 25010 (ISO 25010, 2011) introduces a *product quality model* that encompasses both internal and external properties of the system and a distinct *quality in use* model that refers to "overall quality of the system in its operational environment for specific users, for carrying out specific tasks".

Quality models are usually structured into a set of characteristics, which are further subdivided into sub-characteristics. However, ISO/IEC 25010 refers to the quality of a generic software product, and thus should be considered only as a framework to be tailored to the specific class of systems under consideration (Polillo, 2012a, 2012b). In particular, as pointed out in Polillo (2012b), Herrera et al. (2010) and Orehovački et al. (2012), web sites have peculiar characteristics that make them different from other software products, and thus require a specific quality model and suitable quality assessment methods. In fact, as highlighted in Polillo (2012a, 2012b), in web sites information architecture and content are more important than data management and algorithmic computation; furthermore, the purpose of web sites is often communication or service, rather then support to routine or complex tasks; finally, web sites are usually continuously evolved, because visitors expect that contents are always up-to-date, and services constantly enriched and improved.

According to this remark, many web site quality models have been proposed in literature over the last fifteen years. They can be coarsely classified into two categories: (i) quality models aimed to adapt or extend the models proposed in ISO/IEC 9126 and ISO/IEC 25010, and (ii) original quality models, derived from experience and surveys with users.

Table 1 summarizes a selection of literature works according to the above classification.

Almost the totality of the works reported in Table 1 adopts the user's perspective as their main reference: users are the ultimate target of a web site, and its quality is that perceived by the users; only a couple of them consider the point of view of the web site owner: Lee and Kozar (2006) investigate the effect of site quality

Table 1
Classification of web site quality models.

Standard-based models		Original models
ISO/IEC 9126	ISO/IEC 25010	
Olsina and Rossi (2002), Ruiz et al. (2003), Olsina et al. (2008) and Stefani and Xenos (2008)	Herrera et al. (2010), Lew et al. (2010), Becker et al. (2012) and Orehovački et al. (2012)	Albunquerque and Belchior (2002), Barnes and Vidgen (2002), Offutt (2002), Abrahão et al. (2003), Ivory (2003), Mich et al. (2003), Moraga et al. (2004), Sampson and Manouselis (2004), Telang and Mukhopadhyay (2004), Yang et al. (2005), Lee and Kozar (2006), Liu et al. (2009), Malak and Sahraoui (2010), Orehovački (2010), Polillo (2012b) and Polites et al. (2012)

on e-business success and Mich et al. (2003) explicitly assert that evaluation depends on the objectives of the site owner. The most recent proposals based on ISO/IEC standards neglect the distinction between external and internal quality and address quality in use only, since it is considered the most important factor affecting user satisfaction and web site success. These proposals extend the standard definition of quality in use either by attaching a specific, web-oriented meaning to its dimensions (Herrera et al., 2010) or by incorporating new characteristics, such as information quality and learnability (Lew et al., 2010; Becker et al., 2012).

Several proposals listed in Table 1 aim at generality and introduce quality models that are supposed to suit both traditional software and web sites. These include, for example, GOCAME (Olsina et al., 2008), SIQinU (Becker et al., 2012) and the models proposed in Albunquerque and Belchior (2002) and Olsina and Rossi (2002). These models are very articulated, require extensive tailoring for practical application, and are difficult to apply in concrete cases, especially without the necessary expertise. For instance, SIQinU requires the availability of huge amounts of data taken from usage logs (Becker et al., 2012), while the models proposed in Olsina et al. (2008) and Stefani and Xenos (2008) are based on complex probabilistic models.

The Web Quality Model (WQM) proposed in Ruiz et al. (2003) encompasses three orthogonal dimensions, namely the web features dimension, the quality characteristics dimension, and the life-cycle processes dimension, each one including a variety of aspects. This model provides a useful classification of web metrics adopted in literature (Calero et al., 2005), but is too articulated for practical application. On the contrary, in Offutt (2002) a simple quality model is proposed, which includes only a restricted set of characteristics, without sub-characteristics, and thus remains at a too abstract level to be directly applied to real cases.

Last but not least, it is worth noting that in some models, characteristics and sub-characteristics are not chosen at the right level of abstraction, and overlapping among them often occurs. For instance, the quality model defined in Barnes and Vidgen (2002) does not clearly identify characteristics and sub-characteristics: indeed, *usability* is in turn decomposed into *usability* and *design*, while *information quality* includes only *information* as a sub-characteristic. As a further example, the five-factor model proposed in Yang et al. (2005) includes *usability*, *usefulness of content*, *adequacy of information*, *accessibility*, and *interaction*; however, this leads to some overlaps, especially between *usability* and *interaction*, as well as between *usefulness of content* and *adequacy of information*. Only a few proposals consider, in addiction to objectively measurable characteristics, also subjective dimensions, such as *user experience* (Herrera et al., 2010; Orehovački et al., 2012), *user satisfaction* (Sampson and Manouselis, 2004; Olsina et al., 2008; Polites