

# Towards Effectively Appraising Online Stores

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**Abstract.** This paper introduces research being carried out into the measurement of the quality of e-commerce systems. Considerable work has been done on software metrics in the last few decades but e-commerce specific metrics seem only applicable to already deployed systems. It is proposed that a set of metrics is needed, which can be applied from the earlier stages of E-Commerce system development to improve risk management. This paper attempts to appraise e-commerce systems by proposing a set of essential attributes for an e-commerce site to succeed. This paper also serves as groundwork for future e-commerce metrication work based on these same attributes.

## 1 Language

Electronic Commerce (e-commerce) is most often referred to as the buying and selling of products and services using the Internet. The British government broadly and completely defines e-commerce as “the exchange of information across electronic networks, at any stage in the supply chain, whether within an organisation, between businesses, between businesses and consumers, or between the public and private sectors, whether paid or unpaid” [1]. Throughout this paper, references to e-commerce systems should be taken to imply a Business-to-Consumer (B2C) type model.

Whatever definition one gives it, E-Commerce is fast becoming a popular means of purchasing almost anything you need from books to diamonds. So much so that it has become an almost discounted fact for a modern-day business to provide its goods/services online. Research reveals that in 2003 online retail sales in the US again jumped by 29.1% from \$13.8 billion in 2002 to \$17.8 billion in 2003. To put things in perspective, in 1999 (only) \$5.4 billion were spent online in the US [2]. Similar trends have been observed in Europe.

With this in mind, focus is naturally drawn to the quality of IT systems used to facilitate commercial transactions, and more specifically the quality of e-commerce systems. The issue of classifying e-commerce systems as being of definable quality can be approached from two aspects: the technical and the business aspects. The technical aspect deals with how such systems actually work. The business aspect is more related to products/service handling. Bearing in mind that an e-commerce initiative (venture) is made up of a sound business model and technical innovation, both technical and business aspects of e-commerce must go hand-in-hand in order for an e-commerce venture to succeed. Although both the technical and business aspects are important for the success of an e-commerce venture, this paper will focus on technical issues.

In order to substantiate this argument, results of various research exercises have been utilised, including a survey which was carried out by the authors of this paper amongst 350 regular e-commerce users.

## 2 How is E-Commerce System Measurement Different?

Apart from the six generic software quality attributes as set out by ISO-9126[6], E-Commerce systems contain certain attributes which would seem to feature more strongly in them than in more generic software systems[10].

Since the first software metrics appeared in the 1970s, new ones have been developed as new technologies surfaced (e.g. Chidamber and Kemerers metrics suite for object oriented design[9]). It is the opinion of this paper's authors, that e-commerce systems have sufficient unique characteristics to merit their own e-commerce metrics and measurements suite. This is not to say that conventional attributes need not be present in e-commerce systems. On the contrary, they maintain their fundamental importance.

Distinguishing factors of e-commerce systems are highlighted in bold text throughout the remainder of this section.

First of all, e-commerce systems are largely content-driven. Customers log on looking for information about products/services, be it a simple price and description, a very detailed technical specification, or the terms of purchase. Enabling customers to effectively browse through a myriad of products and providing them with exactly all the information they need can be a challenging task, especially when considering that different customers may have different needs. Issues arise as to how to organize content in a system, how to prioritize it, how to allow users to navigate through content and so on. Clearly, navigability would be an important attribute to consider when appraising an e-commerce site.

More than any other type of software applications, e-commerce systems are exposed to the world. Given the open nature and main intent of the Internet many aspects of the Internet can work against the security interests of an e-commerce website[10]. This highlights two other important attributes: security and privacy. In most cases, a customer will trust an online vendor with personal information with the proviso that his/her personal data is protected and will not be misused in anyway. A betrayal of this trust, whether intentional or not, could have serious negative repercussions on the vendor.

Another distinguishable feature of e-commerce systems is that they are mostly browser-based. The HTTP protocol is not so user-friendly when compared to the event-driven programming that most of us are used to when developing user-interfaces. Functionality that we have grown accustomed to in other paradigms present a much tougher challenge. Scripting languages such as JavaScript<sup>TM</sup> and more recently the emergence of the Microsoft .Net<sup>TM</sup> framework attempt to tackle this problem but then again, support for these technologies is not the same on all browsers[11]. This presents problems relating to usability and portability of web systems.

A site becoming popular will generally translate to an increase in profits to a vendor but there is another side to having an enormous user base. It should be ensured, that the site performs as well with a million hits a day as it would with 1000 hits a day. As Deters[12] puts it, having fast and dependable access to the most relevant information available is of the utmost importance in a competitive information-oriented society. Therefore, performance and scalability become key issues. The research presented later in this paper indicates that only 18% of users are likely to remain unconditionally loyal to an e-commerce site after its performance degrades due to increased popularity. Another problem associated with having a large number of hits is the problem of portability. The higher the number of hits experienced by an e-commerce site, the higher the chances are that the given site is being accessed from different devices, operating systems, and browsers. This can cause problems especially if a site is using technologies that are not universally implemented or uniformly rendered in different environments. Also, having a large customer-base poses a problem with defining a mechanism for customer feedback.

Lastly, e-commerce systems are likely to change quite often. Whether it be changing site content, site aesthetics or even site functionality. Just like in any software system, changes to a site will introduce additional risks of failure thus affecting its reliability. Clearly, a change in site functionality carries more risk than a change in content. However, even a simple change in website content can bring with it layout problems (text too long, image of an incorrect size or missing, etc.) potentially causing a deterrent to new customers. Developers should make sure that a site ages well, indeed matures, as changes are implemented. This is reflected in the generic software attribute of maintainability.

### 3 Survey Design

A survey can be a powerful tool to figure out what your market needs and how you can market to them[18]. The main *raison d'être* for online stores is to be sold so-to-speak to everyday online shoppers. Therefore it was deemed imperative at this stage to elicit and highlight online shopper opinion.

On the basis of the e-commerce quality attributes identified above, a survey was designed to help obtain a user perspective on the issues involved in e-commerce systems appraisal. The survey was divided into two sections. The first section focused on collecting information about the participants that would later help filter results and identify sub-trends according to certain criteria (e.g. age, education level, etc). The second section was designed to tap into the participants view on the quality of e-commerce systems.

Based on the discussion in section 2 of this paper, the following attributes were felt to be relevant regarding e-commerce systems:

- Security and Privacy
- Portability
- Performance and Scalability
- Navigability, Usability and Aesthetic Features
- Multi-lingual Features
- Low-Bandwidth version of sites
- Reliability

The questionnaire was therefore designed to elicit information relevant to the above attributes. It should be noted, that due to paper length requirements, it was decided not to include the explanation and justification regarding the structure and choice of questions in the survey. However the actual questionnaire together with supporting explanatory documentation can be accessed at <http://www.cs.um.edu.mt/~mmica/survey>

### 4 Results

This section will discuss results from the survey and propose a set of attributes which should be deemed essential in an e-commerce system in order for it to be considered a quality system.

Please note, that some figures collectively amount to more than 100% because users were offered the possibility to make multiple choices.

## 4.1 General Observations

One of the first steps taken when analyzing the data was to analyze the user sample. Just over 95% of participants claim to use Internet Explorer™ whilst 7% use Netscape™. Other browsers compare poorly. Also, the Microsoft Windows™OS family seems to be the most popular amongst our sample with over 98% of users using Windows™. Linux/Unix come in second with 8.92%. With regards to device usage, the desktop PC claims the top spot with 92.9% of users using desktop PCs for e-commerce transactions. 24% use laptops whilst mobiles and PDAs trail with 5.23% and 1.85% respectively. These figures compare well with other usage surveys that have been carried out[13][14].

Regarding demographics, 94% of participants were under 50 years old and the most popular items bought online are books with 80% of users having bought books online. Consequently, other popular purchases ranked as follows: Software (32%), hardware (29.6%) and music (29.3%). 71.9% of users claim they would be negatively affected had e-commerce not been available to them.

Disturbingly, 77% of users claim to have abandoned transactions mid-way through. The top reasons for this were stated as:

- User decided (s)he did not want the product (43%)
- Website Error (36%)
- Purchasing Process too long (35%)
- Site too slow (33%)
- Delivery, Payment, or pricing problems (14%)
- Browser Compatibility Problems (4%)

## 4.2 Security and Privacy Issues

Security turned out to be the attribute that was perceived by most participants to be of great importance. 35% of respondents claimed that if they were to choose a reason not to use e-commerce, it would be for fear of compromised security. It is interesting to note that another 30% would not choose e-commerce because they prefer to physically touch goods before buying them. This might be interpreted as users not trusting online vendors outright when it comes to delivering good quality products. Also, when asked how sure they would have to be of a sites capability to offer them security and privacy before they purchased from it, 43.5% of the users said they would have to be as certain as they possibly can be (water-tight privacy policy, secure connection, etc.). A further 42% said they would also buy if they had minor doubts (such as there being a risk of the site giving their e-mail to third parties). Security was placed first when participants were asked to rank quality attributes in order of importance. It obtained an average score of 6.235 (out of a maximum of 7). Surprisingly, 33 participants 13.87% claimed that security was not an essential attribute they would look for in an online store. However, on closer examination, these participants might have been inconsistent because when looking at their answers in isolation, they still placed security as the most important attribute with a score of 6.182. It can be safely concluded that security is an indispensable attribute in e-commerce systems.

## 4.3 Portability

Portability in e-commerce systems refers to the extent to which a system is accessible from different operating systems, browsers and devices without loss in functionality. The case for portability is not a strong one if one relies on the results of this survey. Consider the following results:

1. Participants ranked portability as the 5th most important attribute (out of 7)
2. 98% of participants use Windows<sup>TM</sup>-based OSs
3. Almost 93% of participants use Desktop PCs
4. Over 95% of participants use Internet Explorer<sup>TM</sup>
5. Less than 4% of users who abandoned transactions midway through did so because of compatibility problems. Less than half of these users were using Internet Explorer<sup>TM</sup>

The results seem to suggest that if an e-commerce system were to be tailored for Windows<sup>TM</sup>-based PCs or laptops using Internet Explorer<sup>TM</sup>, any portability problems with other systems would cause minimal negative repercussions in the vendors business. Nevertheless, one should always remain vigilant with regards to portability issues. Firstly, when asked whether or not they would be willing to install another browser if an e-commerce site was not compatible with the one they were currently using, 88.65% of users said they would not. Therefore one must keep a close eye on the market share commanded by browsers and operating systems and invest in the portability of e-commerce sites as necessary. Another concern is the much talked about rise of mobile commerce (m-commerce). Even though early high hopes for M-Commerce failed to materialise in the first years of this century[15], falling costs and faster mobile networks have raised hopes on the feasibility of M-Commerce[16].

Portability is being recommended as a necessary attribute by the authors of this paper although in the current environment, compatibility with dominant technologies would seem to ensure a far greater reach and influence of online shoppers.

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#### 4.4 Performance and Scalability

Speed is important to users. Over 33% of users who abandoned transactions mid-way through did so because the site was too slow. Also, when asked how they would react if their favorite e-commerce site experienced performance degradation due to popularity, only 18.4% of users claimed they would remain loyal. However, 57% claimed they would try to use the site at off-peak times in order to get better performance. It is also worth noting, that 22% of participants consider the speed of a site the most important first impression factor. This would mean that when they first visit a site, the primary deciding factor on whether they decide to stay or not is performance. This is backed up by the popular 7-second rule, which states that a web page should take no more than 7 seconds to download and display to the site visitor on the slowest probable connection[10]. Participants rated performance as the 4th most important attribute in an e-commerce system with an average score of 4.128 (out of a possible 7). The authors are therefore recommending performance as a required attribute in all e-commerce systems.

#### 4.5 Navigability, Usability and Aesthetic Features

Of the 77% of users who have abandoned transactions mid-way through, 35.6% did so because the process was seen as being too long. Also, these same users were more likely to look for an alternate site after abandoning a transaction rather than try again or contact the vendor by other means. This suggests that poor usability will have a tremendous impact on the success of an e-commerce site.

72% of users know beforehand what they are looking for when visiting an e-commerce site. This indicates that good search and navigation features are important in e-commerce systems. 30% of participants also chose good navigation as the primary first impression factor.

With regards to aesthetics, only 6.7% of users rate aesthetics as the primary first impression factor.

Navigability was ranked as the third (out of seven) most important attribute in e-commerce systems with an average score of 5.492 (out of a possible 7).

Usability with an emphasis on navigability would therefore be recommended as an essential attribute of e-commerce systems.

#### 4.6 Multilingual Features

The importance of multilingual features depends very much on the context in which an online store is operating. For example, in some regions of northern Italy, both Italian and German are spoken to varying degrees. Therefore, an online store servicing such regions would do well to provide both Italian and German versions of its site. Respondents ranked multilinguality as the sixth (out of seven) most important attribute with an average score of 2.043 (out of a maximum of 7). Also, almost 51% of participants claim that an e-commerce system could still be classified as a quality e-commerce system if it did not have multilingual features. The reason for this might be that one tends to automatically use e-commerce sites in one's own language. Therefore users might not really be aware of the multilinguality problem.

Providing multilingual versions of an e-commerce site does not simply involve translating content into different languages. Besides there being a vast research area into the technical issues involved in offering such a service, there are also accompanying business and legal structures that would also need to be set up. For example, what happens if Japanese speaker places an order and needs customer support? The vendor would also need to have multilingual customer relationship management (CRM) processes in place. A recent study claimed that 46% of companies interviewed turn away international orders because they do not have the processes in place to handle them[19]. Implementing such processes would clearly require a certain amount of resources which most businesses, especially those in their early stages might not be able to afford. Therefore it might make more sense for businesses that are not large multi-national corporations to concentrate on markets where only one language is spoken and expand multilingual features as business grows.

Although a desirable attribute, multilinguality is not being recommended as an essential attribute by the authors of this paper.

#### 4.7 Low-Bandwidth Version of Site

Some e-commerce sites have a text-only or low-bandwidth version available for users with slow connections. When asked about the importance of this feature, participants in the survey ranked it as being the least important attribute of all (average score of 1.587). Also, 52.5% of participants deem the feature to be unnecessary in an e-commerce site. Considering the increased Internet bandwidth available to users and the increasing popularity of broadband communications[17] as well as the giant strides in technology as a whole, the authors are not recommending low-bandwidth versions as an essential attribute of an e-commerce system.

#### 4.8 Reliability

Reliability is considered to be an extremely important attribute in e-commerce systems because of the following indicators:

1. 36.6% of users have abandoned transactions midway through due to website errors
2. Reliability was ranked as the second most important attribute by participants with an average score of 5.55 out of a possible 7.
3. Almost 37% of users consider a sites reputation as the primary first impression factor when they first visit it and a site with frequent errors and crashes is unlikely to gain a good reputation.

Considering the above results from the survey, the authors recommend reliability as an essential attribute of e-commerce systems.

## 5 Conclusions and Future Work

Based on results of the survey and other research cited in this paper, a number of quality attributes are being recommended as being essential to e-commerce systems. That is to say, that no e-commerce system can be reasonably expected to succeed if it does not exhibit a considerable degree of each recommended attribute. The attributes are also being given an importance ranking as follows (most important first):

1. Security
2. Reliability
3. Navigability
4. Performance
5. Portability

Further work needs to be done before online store quality can be effectively measured. One still needs to define the minimum level of each characteristic that an e-commerce system needs to exhibit. In order to do that, each attribute should be measurable in some way. Therefore, the next step in the ongoing research will be to define a metrication and measurement framework for these attributes. When that is achieved, some form of progressive benchmarking system could be defined whereby e-commerce systems can be classified as being of a given quality depending on the level of each attribute exhibited by the system.

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