

QUALITY MODEL FOR COMPARATIVE ANALYSIS OF WEBSITES DEDICATED TO E-COMMERCE APPLICATIONS

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Abstract

The main objective of the study is to develop a hierarchy of a number of sites dedicated to electronic commerce applications according to a quality model.

The big number of sites for electronic commerce has led naturally to a strong competition between them and automatically to an evolution of quality characteristics. Thus the software quality domain imposes naturally in production of web applications. Later were established quality models and quality standards.

To assess a site in terms of quality first is created a quality model. A quality model contains a set of characteristics that are evaluated according to metrics.

Creating the quality model

A good quality characteristics' model for evaluating the e-commerce sites contains both general quality criteria for software products and custom criteria for sites for electronic commerce.

As quality characteristics are selected the followings:

- Factor **Functionality** with quality characteristic **Completeness** – the extent to which a web site offers the client useful tools and information. Development opportunities: posting information about products - implementing a product catalog, a product selector to help customers choose the best product for them; posting technical documents about products, white papers; posting contact information - address, phone; implementing of online payment; posting news.

- Factor **Visibility** with quality criterion **Traceability** – the ease with which a user can find a web site. Development opportunities: suitable and meaningful URL, good position and placement in the search results across 3 major public search engines.

- Factor **Engageability** with criteria **Navigability**, **Interactivity** and **Appeal** – the extent to which a visitor achieves a complete experience at a web site [FITZ04]. Development opportunities: ease of navigation, implementing of a search engine inside the web page, creating of user's profiles, implementing a tool for capture the customer satisfaction feedback, chat rooms, reach media content – video, pictures, games, sounds.

- Factor **Differentiation** with criteria **Specialty**, **Identity** – the extent to which a web site demonstrates corporate superiority [FITZ04]. Development opportunities: special offers and dominant product, promotional events.

Quality factors	Characteristics	Analyzed elements
Functionality	- completeness	- product catalog - product selector - product news, newsletters, press releases - online product brochure catalog - locator - payment and presentment
Visibility	- traceability	- public search placement
Engageability	- navigability	- navigational taxonomy

	- interactivity - appeal	- search engine - customer profiling - customer satisfaction feedback - reach media content
Differentiation	- specialty	- product campaigns, offers

Table no. 1: Analyzed elements for evaluate web sites quality

Metrics for quality model

The scale chosen for assessing quality characteristics is proportional. A value of 0 means that the characteristic is missing, while a maxim value (4 or 5) means that the characteristic is present and its implementation is complex. The difference between two consecutive gradations is one unit.

For characteristic Functionality – Completeness:

Element	Metric	Rating Criteria
Product Catalog	0	The feature was not observed on the subject site.
	1	Static product list: The product catalog is presented as a static product list. This feature level may include categorical/alphabetical navigation to facilitate navigation of large lists. May also come in the form of an electronic document (ex. MS Word).
	2	Searchable/ filterable product list: Product list that provides some filtering capability by product line or price, and/or provides basic search capability within a static document.
	3	Bundler/ synchronization: An interactive product catalog which may use multi-media functionality to facilitate the bundling and assembly of products online. This rating also refers to any support for product catalog synchronization from a B2B perspective.
	4	Configurator: An interactive product catalog that offers dynamic/on-the-fly product configuration capabilities and modeling. This feature should allow customer to customize their purchases.
Product Selector	0	The feature was not observed on the subject site.
	1	Informational list: Static page that presents a list of products with text and optionally, graphics. Can also be represented as a document (ex. MS Word).
	2	Filter and search: Product list that provides some filtering capability by product line or price, and/or provides basic search capability within a static document.
	3	Recommendation script: A form-based tool that provides product recommendations based on simple needs assessment.
	4	Recommendation engine: Interactive application that provides targeted product recommendations based on a multi-parameter analysis of customer need/preference. The needs analysis may also be diagnostic / prescriptive.
Product News, Newsletters, Press Releases	0	The feature was not observed on the subject site.
	1	Static content delivery: Product news is rendered as static content elements (text and/or graphical) on a page.
	2	Dynamic content: Product new content is rendered via dynamic elements that provide visual enhancement, and may add audio to the presentation. Observed interactivity is low and limited to links to related information.

	3	Interactive/multi-media content: Product news content is delivered in rich-media formats that provide compelling audio and visual experiences. The feature may also exhibit dynamic navigational functions such as scrolling, dynamic filtering, etc.
	4	Syndicated content delivery: The product news is delivered via a syndicated content infrastructure and enabled by protocols such as RSS. The content is rendered dynamically by subscription.
Online Product Brochure Catalog	0	The feature was not observed on the subject site.
	1	Static catalog: Link page to brochure documents.
	2	Simple filtering: The product catalog incorporates a categorical filter that facilitates the location of product literature. This rating will also apply to the placement of document within product profile pages as related links.
	3	Parametric filtering: A catalog that provide interactive interface to parametrically filter and locate product literature within a document repository.
	4	Taxonomy and text search: The catalog is able to perform taxonomy-based and full-text search of product literature.
Locator	0	The feature was not observed on the subject site.
	1	Static contact list: The locator is implemented as a static list or document that contains the roster of contacts.
	2	Static filtering: The locator provides location based filtering and/or a hyperlink map that facilitates navigation through a static list/roster, or a simple, one-field drop-down filter.
	3	Dynamic/interactive filtering: A dynamic content or multimedia element in the form of interactive maps or dynamic filter forms (drop-down fields) that offer systematic/logical filtering/location of contacts. Integration with map.
	4	Intelligent filtering: Locator that incorporates zip code based search and search by other parameters such as products handled sold at a location. May also include proximity search as well where the user can specify how large the search range is from a zip code or address/city.
Payment and Presentment	0	The feature was not observed on the subject site.
	1	E-mail: E-mail based confirmation and presentment. Payment transactions are typically enacted over the phone.
	2	Online payment transaction: The observed website is able to handle online payment transactions does not present a closed-loop payment and presentment solution online. Presentment is handled via-e-mail or hardcopy.
	3	Online payment confirmation and presentment: The observed site is able to handle online payment and provide automated order confirmation online. The site will also provide hardcopy print options and e-mail confirmation options. The observed site may also present integration with a full-service payment service such as Pay Pal.
	4	Integrated online tracking: The observed site provides customers with information on their payment history, payment tracking as well as store customer payment information to facilitate future transactions.

Table no. 2: Metrics and evaluation criteria for completeness

For characteristic Visibility – Traceability:

Element	Metric	Rating Criteria
Public Search	0	Could not navigate to the subject site via search results using a leading search engine on the public domain.

Placement	1	Very low presence: The company is not referenced in the top 10 of results on a keyword or categorical search consistently across 3 major public search engines.
	2	Low presence: The company is placed at least once in the top 10 of results on a keyword or categorical search consistently across 3 major public search engines.
	3	Frequent presence: The company and/or its products are referenced as one of the top 10 results consistently across 3 major public searches.
	4	Premium placement: The company and/or its products are referenced at least once as one of the top 3 results across 3 major public search engines.
	5	Dominant placement: The dominant position and placement in the top 3 search results consistently across 3 major public search engines.

Table no. 3: Metrics and evaluation criteria for traceability

For characteristic Engageability – Navigability, Interactivity and Appeal:

Element	Metric	Rating Criteria
Navigational Taxonomy	0	The observed site had no navigation beyond the landing page.
	1	Static navigation: The navigation of the site is static and does not change in a dynamic fashion.
	2	Dynamic navigation: The navigational taxonomy of the site is static, but it uses dynamic elements to enhance usability, such as fly outs and drop-down menus.
	3	Role-based navigation: The navigational taxonomy of the site may change based on the business-defined role of a user, hence delivering differing navigation on a same site structure based on role.
	4	Personalized navigation: The navigational taxonomy of the site is personalized based on a user's profile, preferences and subscriptions. The site will hide navigation paths that are not relevant to the user per their profile/preferences/role.
Search Engine	0	The feature was not observed on the subject site.
	1	Basic search: The observed site offers simple keyword-based search.
	2	Advanced search: The observed site offers advanced search functionality such as relevancy scores, metadata-based filtering, etc.
	3	Category/taxonomical search: The observed site offers categorical and taxonomical filtering of search results and search queries.
	4	Intelligent search: The observed site offers advanced search functionality such as natural language search and fuzzy logic search.
Customer Profiling	0	The feature was not observed on the subject site.
	1	Telephone registration: Users are prompted to register via telephone. Provisioning of a user on the site is handled manually or by script by a site administrator.
	2	E-mail submission: Users register by submitting an e-mail request, which will result in a return e-mail that will contain the user's password.
	3	Online registration: Users register online using a form-based application which will provide a password via e-mail. The users are also able to reset or change their passwords online.
	4	Dynamic/automatic registration: Users are registered automatically through contact information capture in other channels such as call centers, event

		registration, etc. Profile may also be context driven.
Customer Satisfaction Feedback	0	The feature was not observed on the subject site.
	1	E-mail feedback: Users must send their customer feedback via e-mail in a structure or unstructured format.
	2	Online feedback form: The observed site provides an online form that allows for the capture and transmittal of a structure feedback document.
	3	Pop-up solicitation: The observed site proactively initiates a feedback request to the user via a pop-up solicitation.
	4	Context-driven feedback request: The observed site intelligently initiates feedback from the user based on context, such as the submission of a service request, or when a product confirmation page is rendered.
Rich Media Content	0	The subject site contained text-based content only.
	1	Audio content/dynamic visual: Audio content via media such as WAV and MP3 files through a plug-in media player, or simple dynamic visual elements using animated GIF files, JavaScript elements.
	2	Basic multi-media delivery: Flash-based content which can provide navigation capabilities.
	3	Real-time multi-media: Streaming video and audio such as internet radio or advanced Flash applications.
	4	Application-based media: Application-based media based on AJAX that provide high-interactivity.

Table no. 4: Metrics and evaluation criteria for engageability

For characteristic Differentiation – Specialty:

Element	Metric	Rating Criteria
Product Campaigns/ Offers	0	The feature was not observed on the subject site.
	1	Static content: Offers are communicated on the site through static content elements, e.g. text or a graphic, which is not interactive, but is merely informational.
	2	Visual/audio media content: Offers are communicated on the site through audio and/or video media formats (Wave audio, Flash, Animated GIF files, JavaScript or Java applets) that provide vocalization, animation or rotation of information/content presented.
	3	Interactive media/applications: Offers are presented through interactive media and/or applications that provides interface to transactional or self-service capabilities such as an inquiry form, online ordering, online chat, or interface with a community forum.
	4	Personalized/portable offers: Features demonstrate portability and/or personalized characteristics. Offers may be portable and transferable to others as gifts, or combined with other offers. Offer terms/details are relevant to a customer/user's preferences or interests.

Table no. 5: Metrics and evaluation criteria for differentiation

Defining e-commerce sites assessment indicators

The selected web sites are assessed element by element. For the four quality factors, indicators are calculated by dividing the points obtained by adding each factor's element evaluation to the maximum possible points. Therefore the general formula for indicators is:

$$I = \frac{\sum_{j=1}^{no_elem} i_{kj}}{p_{max} * no_elem}, \text{ where:}$$

k is the index of the web site,

j is the index of the assessed element,

p_{max} is the maximum mark that can be obtained,

no_elem is the number of elements taken into consideration when evaluating the factor.

Each quality indicator is a $[0,1]$ valued function. For a value close to 0 the indicator marks an insignificant presence of assessed quality characteristic and for values close to 1 the indicator marks a high level implementation of quality characteristic.

According to the previous formula the quality indicator for the functionality factor is calculated thereby:

$$I_1 = \frac{\sum_{j=1}^6 i_{kj}}{4 * 6}, \text{ where } k \text{ is the index of the web site and } j \text{ is the index of the assessed element.}$$

The indicator is a function of the 6 elements $I_1 : M_1^6 \rightarrow [0,1]$ and $M_1 = \{0,1,2,3,4\}$.

The formula for the visibility indicator is:

$$I_2 = \frac{i_k}{5 * 1}, \text{ where } k \text{ is the index of the web site.}$$

The indicator is a function $I_2 : M_2 \rightarrow [0,1]$ and $M_2 = \{0,1,2,3,4,5\}$.

The indicator for engageability is calculated using the following formula:

$$I_3 = \frac{\sum_{j=1}^5 i_{kj}}{4 * 5}, \text{ where } k \text{ is the index of the web site and } j \text{ is the index of the assessed element.}$$

The indicator is a function $I_3 : M_3^5 \rightarrow [0,1]$ and $M_3 = \{0,1,2,3,4\}$.

For the last characteristic (differentiation) the indicator is calculated as follows:

$$I_4 = \frac{i_k}{4 * 1}, \text{ where } k \text{ is the index of the web site.}$$

The indicator is a function $I_4 : M_4 \rightarrow [0,1]$ and $M_4 = \{0,1,2,3,4\}$.

The sites are ordered by each factor or by a general aggregate indicator. Using this indicator the sites are sorted by quality taking into consideration all characteristics and their importance. The aggregate indicator I_A is a mathematical expression determined in the following mode:

$$I_A = \sum_{j=1}^n p_j I_j,$$

p_j – coefficient of the importance of quality characteristic j . The coefficients of the importance are assigned to quality characteristics by a number of experts in software quality and have the property:

$$\sum_{j=1}^n p_j = 1.$$

Coefficients of the importance chosen for the quality model described in this paper are $p_1 = 4/10$, $p_2 = 3/10$, $p_3 = 2/10$ and $p_4 = 1/10$. The functionality factor is considered the most important. It is followed by visibility, engageability and differentiation.

The web sites selected for evaluation are:

- M1 - ExxonMobil: <http://www.exxonmobil.com/corporate/>
- M2 - British Petroleum: <http://www.bp.com/home.do?categoryId=1>
- M3 - Castrol: <http://www.castrol.com/castrol/castrolglobalhomeflash.do>
- M4 - Chevron Texaco: <http://www.chevron.com/>
- M5 - Shell: <http://www.shell.com/>

The evaluation results for each factor are shown in the next tables.

	M1	M2	M3	M4	M5
Product catalog	2	1	1	1	2
Product selector	4	1	3	1	1
Product news, newsletters, press releases	1	1	1	0	1
Online product brochure catalog	1	2	2	3	2
Locator	3	3	3	4	3
Payment and presentment	0	0	0	0	3
Functionality (I_1)	0,46	0,33	0,42	0,36	0,5
Public search placement	1	0	3	1	2
Visibility (I_2)	0,2	0	0,6	0,2	0,4
Navigational taxonomy	2	1	2	1	1
Search engine	2	1	1	0	2
Customer profiling	3	0	4	3	3
Customer satisfaction feedback	2	2	2	1	2
Reach media content	3	0	3	0	4
Engageability (I_3)	0,6	0,2	0,6	0,25	0,6
Product campaigns, offers	2	0	3	0	2
Differentiation (I_4)	0,5	0	0,75	0	0,5
Aggregate indicator (I_A)	0,414	0,172	0,543	0,254	0,49

Table no. 6: Quality indicators for analyzed web sites

Web sites assessment quality indicators

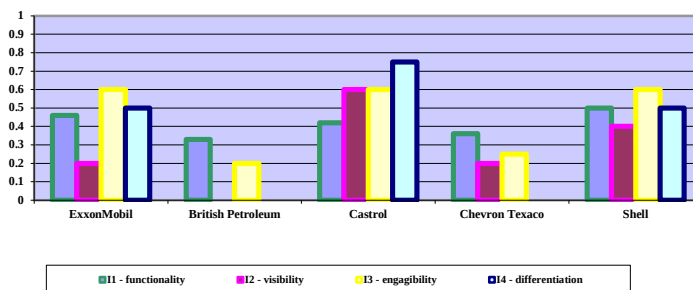
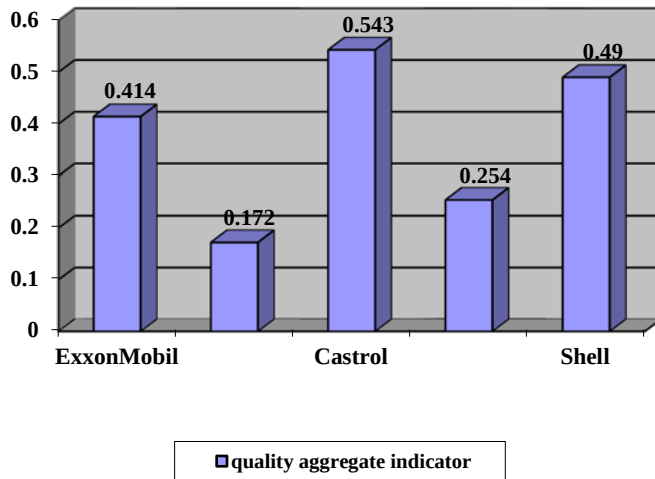


Fig. no. 1: Quality indicators for analyzed web sites

Quality aggregate indicator



Conclusions:

The hierarchy of the web sites in reverse order of quality according to the described model is:

- Castrol
- Shell
- ExxonMobil
- Chevron Texaco
- British Petroleum

Besides the main goal – that of ordering the e-commerce websites based of certain quality factors – the project emphasizes the importance of identifying and defining the quality factors for e-commerce web sites.

Just as any product's quality is appreciated and recognized by the customer - regardless of its nature, so the software products and producers will be able to resist the market pressure only through imposing and maintaining optimal quality levels. The need for software is continuously growing and because of the increasing competition only quality products will remain on the market. In the software world changes take place at a swifter pace than in any other field and producers can assure future success only by keeping a very high level of quality.

Bibliography

	http://www.anrcti.ro/DesktopDefault.aspx?tabid=3024
	http://www.link2ec.ro/
	http://ro.wikipedia.org/wiki/E-commerce
	http://en.wikipedia.org/wiki/Electronic_commerce
	http://www.bth.se/tek/besq.nsf/(WebFiles)/CF1C3230DB425EDCC125706900317C44/\$FILE/chapter_1.pdf

[BALT04]	Baltac, V.: <i>Comerțul electronic</i> , Softnet, București, 2004
[FITZ04]	Fitzpatrick, R.: <i>Software quality revisited</i> , Arrow@dit, 2004
[IVAN01]	Ivan, I., Teodorescu, L., <i>Managementul calității software</i> , Editura Infocrec, 2001
[IVAN06]	Ivan, I., Amancei, C.: <i>Stabilitatea coeficienților modelului global de calitate software</i> , Editura ASE, 2006
[IVAN06]	Ivan, I., Noșca, Gh., Căpășanu, S., Popa, M.: <i>Managementul calității aplicațiilor informatice</i> , Editura ASE, București, 2006
[KHOS06]	Khosrow-Pour, M.: <i>Encyclopedia of E-Commerce, E-Government, and Mobile Commerce</i> , Volume 1, 2, Editura Idea Group Reference
[KSHI08]	Kshirasagar, N., Priyadarshi, T.: <i>Software testing and quality assurance</i> , Wiley, 2008
[PIST07]	Pistol Gh. M.: <i>Bazele comerțului</i> , Editura Fundației România de Măine, București, 2007
[RADU08]	Radu, A., Gămulescu, C., Manolea, B., Taloi, L.: <i>Studiu privind dezvoltarea comerțului electronic în România</i> , Linkecommerce, 2008
[VASI04]	Vasilache, D.: <i>Plăți electronice</i> , Editura Rosetti, București, decembrie 2004
[VASI07]	Vasilache, D.: <i>Guvernarea electronică. O introducere</i> , Casa cărții de știință, București, 2007