Quality Evaluation of E-Government Website Using Web Diagnostic Tools: Asian Case

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Abstract

In recent years, many people have devoted their efforts to the issue of quality of Web site. The concept of quality is consisting of many criteria: quality of service perspective, a user perspective, a content perspective or indeed a usability perspective. Because of its possible instant worldwide audience a Website's quality and reliability are crucial. The very special nature of the Web applications and Websites pose unique software testing challenges. Webmasters, Web applications developers, and Website quality assurance managers need tools and methods that can match up to the new needs. This research conducts some tests to measure the quality of e government web site of five Asian countries via web diagnostic tools online. The result of this study confirmed that the E-government websites of Asian are neglecting performance and quality criteria.

1. Introduction

Websites are something entirely new in the world of software quality, within minutes of going live. A web application can have many thousands more users than a conventional, non-Web application. The immediacy of the Web creates an immediate expectation of quality and rapid application delivery, but the technical complexities of a website and variances in the browser make testing and quality control more difficult, and in some ways, more subtle. Automated testing of Websites is both an opportunity and a challenge. A Website is like any piece of software: no single, all-inclusive quality measure applies, and even multiple quality metrics may not apply.

There are many dimensions of quality, and each measure will pertain to a particular website in varying degrees. Here are some of them: time, a credible site should be updated frequently. The information about latest update also should be included on the homepage. However, if the information has not been updated currently, the visitor could easily know that perhaps the site manager does really bother to update the site. Second is structural, all of the parts of the website hold together and all links inside and outside the website should work well. Broken links on the webpage also are another factor that always downgrades the quality of website. Each page usually has references or links or connections to other pages. These may be internal or external web site. A user expects each link to be valid, meaning that it leads successfully to the intended page or other resource. In a 2003 experiment, discovered that about one link out of every 200 disappeared each week from the Internet [1]. The third factor is content; number of the links, or link popularity is one of the off page factors that search engines are looking to determine the value of the webpage. Most of search engine will need a website to have at least two links pointing to their site before they will place it to their index, and the idea of this link popularity is that to increase the link popularity of a website, this website must have large amount of high quality content. Number of links to website improves access growth and helps to generate traffic [2].

$$PR(A) = (1-d) + d(PR(t1)/C(t1) + ... + PR(tn)/C(tn))$$

PR = page rank
t1 – tn = are pages linking to page A
C = is the number of outbound links that a page has
D = is a damping factor, usually set to 0.85.

Search engine such Google make a citation analysis to rank hits, then a website which has a many links to it will have a higher ranking compare than a website with a few links. This indicator can be used to measure the quality of web site. Fourth is response time and latency, a website server should respond to a browser request within certain parameters, it is found that extraneous content exists on the majority of popular pages, and that blocking this content buys a 25-30% reduction in objects downloaded and bytes, with a 33% decrease in page latency. Popular sites averaged 52 objects per page, 8.1 of which were ads, served from 5.7 servers [3], and object overhead now dominates the latency of most web pages [4]. Following the

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recommendation of the HTTP 1.1 specification, browsers typically default to two simultaneous threads per hostname. As the number of HTTP requests required by a web page increase from 3 to 23, the actual download time of objects as a percentage of total page download time drops from 50% to only 14%, an the last criteria is performance.

There are so many factors influence the performance of the web and most of it is outside the control of website designer. Download time of the website will be determined web page design, web server, hardware of the client, software configuration, and characteristics of the internet router which connect user and the website. One of the research finding mention that website which has slow download time less attractive compare than website with faster download time [5]. In the recent time the average time of the connection speed is 5Kbps (*kilobytes per second*). This facts give an implication that one web page with 40Kb page size will be downloaded during 8 second. This matters in accordance with the 'eight second rule', this 8 second is a normal time for loading webpage and will not be tolerable from the user. This result are supported by many research result mentioned that mean of tolerable download time in the user side is 8.57 with standard deviation 5.9 second [6]. Providing information related with waiting time is very important for user. For the long download time, it is better to provide information about how many percentage of the webpage already downloaded and how many hours needed to complete this task.

2. Methodology

This research stages will start with problem identification followed by research procedure and sample of data explanation.

1) Problem identification

Every webpage design has their own characteristics and this characteristic has drawbacks and benefits. There is a mechanism for measuring the effects of the webpage component toward the performance and quality of website. This mechanism will measure size, component, and time needed by the client for downloading a website. The main factor that will influences this download time are page size (bytes), number and types of component, number of server from the accessed web. Research conducted by IBM can be used as a standard for performance measurement of quality [7]. Standard international download time for this performance can be used as a reference to categorize the tested webpage. After we have done with data, and then continued by testing of data.

Table1. Standard of the website performance

Tested Factor	Quality Standard
Average server response time	< 0.5 second
Number of component per page	< 20 objects
Webpage loading time	< 30 second
Webpage size in byte	< 64K

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2) Web Diagnostic Tools

We used a number of widely available web diagnostic tools online, thus we used widely available website performance tool and webpage speed analyzer online service (http://www.websiteoptimization.com). List of performance measured and reported by this service include total size, total objects and number of objects (HTML, images, CSS, scripts), and download times on a 56.6kbps connection, another available online tools that we used are: http://validator.w3.org/checklink which was utilised in order to monitor broken links in the HTML code of the portals, while the W3C's HTML validator (http://validator.w3.org) was used to validate the HTML code of the portals. Link popularity (www.linkpopularity.com) is used to determine the amount and quality of links that are made to a single website from many websites. This research also conduct using tawdis software for testing whether the webpage tested already fulfill the criteria to be accessed by people with dissabilities. This software has an ability to conduct an online test for webpage refer to the criteria setup by W3C-WCAG. Tawdis software can be downloaded from www.tawdis.net. Testing using tawdis consist of test for HTML code for knowing whether the webpage can be read by screen reader, and testing for knowing is there any alternative text for every single picture, animation, video, and audio in the webpage. Tawdis software tester can cover almost 90% of the item demanded by WCAG (watchfire). Tawdis will give a repot about an item, which is not meet with the requirement, how many mistakes in every item, line error of the HTML code. The last tool to be employed in our study was colorblind webpage filter http://colorfilter.wickline.org *w*hich simulated how the color schemes used by the respective portals impacted upon people with various forms of color blindness. Three types of color blindness are simulated: deuteranopia and protanopia

(both of which are forms of red/green deficiency), and tritanopia (a rare blue/yellow deficiency).

3) Sample Data

In order to get the data for this research, we examined e-government websites from five Asian countries: The e-Government portals were not randomly selected, but a careful process was undertaken. Rather than selecting any generic e-Government web portal this research attempted to evaluate the web portals of governments that are considered to be leaders in the area of e-Government based on the result of Waseda University World e-Government Ranking. By doing such an approach it was felt that measures of 'best practices' could emerge. As explained before, we examined the national e-Government portals of a selected number of countries and their web addresses are provided along with the names, which are: Singapore (http://www.gov.sg), Korean (http://www.korea.go.kr/eng), Japan (http://www.kantei.go.jp/foreign/index-e.html), Hongkong (http://www.gov.hk), and Malaysia (http://www.gov.my).

3. Result and Discussion

Results of the websites quality test based on server response, load time, size, and number of items, markup validation, and broken link are showed in table 2.

Table2. Testing Result for Websites Performance Based on Criteria

Website quality Category	.sg	.kor	.jp	.hk	.my
response time (seconds)	1.869	0.982	1.164	0.849	1.462
Load time (<30 seconds)	30.79	148.45	65.01	41.94	93.99
Size (<64 Kbytes)	128404	667584	267978	195384	448508
Number of items (<20 items)	26	77	58	15	23
Markup Validation (zero error)	86 Errors	14 Errors	15 Errors	3 Errors	83 Errors
broken link(n)	5	0	0	0	16

The data in table 2 shows that most of the websites in Asian can not meet the criteria as a high quality website. Most of server response, load times, size, and number of items exceed the value standardized by IBM, except Hongkong websites in number of items criteria. Implementation of the W3C's HTML validator highlighted that none of the Asian e government website had HTML 4.01 valid entry page, most of it did not have DOCTYPE declarations. Consequences of this problem will be on the portability and development of the website. In term of broken link, two e-government website or 40% of the sample have a broken link. Table 3 showed that in term of ranking, link popularity of the e-Government website are different with the result of the Waseda University World e-Government Ranking. Based on Waseda University World e-Government, the ranking are Singapore, Korean, Japan, Hongkong, and Malaysia, while based on link popularity using google search engine the sequence are: Hongkong, Singapore, Malaysia, Japan, and the last ranking is Korea. Similar result is occurred by using yahoo search engine with ranking number one is Malaysia, followed by Singapore, Japan, Hongkong, and Korea as the last ranking.

Table3. Testing Result for Number of link In search engine

E-Government	Goggle	Yahoo
www.gov.sg	2650	105913
Www.korea.go.kr	454	49005
www.kantei.go.jp	1810	91038
www.gov.hk	8180	59876
www.gov.my	2190	132804

Website speed optimization continues to provide significant improvements for e government and can have a large impact on its quality. Despite the increasing broadband adoption, slow downloads continue to be a cause of slow web browsing which can be one of the most frustrating experiences. The optimizations are organized into three basic categories including image, website design, and HTML code optimization. This optimization can be improved by reducing the complexity of the HTML coding, improving the quality of your website's images, and increasing the overall usability. Based on table4, in term of css and javascript objects, one e-government has not used this object, while other websites have optimization more than 85%. Optimization oobjects

with a mime type of text or JavaScript for e government websites is less than 35%, the highest ranking for this optimization are: Hong Kong, Japan, Singapore, Malaysia, and Korea. For image, the best rank is Korea with 96% with the lowest rank is Hong Kong, 32%. Keep alive indicator is used for all objects that are from a domain that serves more than one object for the page, and only Singapore has 97% optimization, while another websites can reach 100%. The last indicator is html, JavaScript and json responses and the result for this category are Korea, Singapore, Hong Kong, Japan, and followed by Malaysia.

Table4. Testing Result for Websites Optimization Based on Criteria

Website Optimization	.sin (%)	.kor (%)	.jp (%)	.hk (%)	.my (%)
Cache static	0	0	0	50	0
Combine CSS/JS	90	na	85	100	100
GZIP text	23	18	31	34	23
Compress images	65	96	41	32	40
keep-alive	97	100	100	100	100
Minify JS/HTML	69	77	68	69	54

When we applied tawdis test online to examine whether the web portals have accessibility errors on their respective web pages, we obtained the results summarized in Table5. We can see that only one portal, namely Hong Kong e-Government ranked the best, with no Priority 1 Accessibility errors, and another e-Government website had Priority 1, 2, 3 errors with a varying number of instances.

Table5. Testing Result for Accessibility errors website

Website	Priority I	Priority 2	Priority 3
www.gov.sg	37	242	34
Www.korea.go.kr	2	6	1
www.kantei.go.jp	1	10	6
www.gov.hk	0	2	1
www.gov.my	13	246	47

Finally, using colorblind webpage filter, all of Asian e-Government portals did not reveal any major visual impairment for all of the three forms simulated color blindness. This shows that designers were very aware of color scheme issues when creating the respective portals.

4. Conclusion

In this paper we evaluate the quality of Asian e-Government websites. Using a series of online diagnostic tolls, we examined many dimensions of quality, and each dimension will be measured by specific test online. The result of this study confirmed that the website presence of Asian e-Government websites is neglecting performance and quality criteria. It is clear in our research that more effort is required to meet with these criteria in the context of website design. This suggests that web developer responsible for e government website should follow and encourage the use of recognised guidelines when designing website. To get results on the quality of a Web site, we measure sample data from e-Government portal in 5 Asian countries and calculate response time, page size, number of item, load, mark validation, and broken link, number of link in search engine, optimization score, accessibility errors, and colorblind webpage filter test. Future research directions lie in evaluating websites from the cultural perspective, since culture has an impact upon a website. Moreover because the ultimate determinant of quality website is the users, future directions for this research also involve the objective and subjective views of the university website from user's perspective.

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