Web Designers Guide on Development Technologies: An Evaluation Approach

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Abstract

The advent of network computing has brought about a lot of technological innovations among which are web development tools. Selecting a suitable one has proven to be difficult. The purpose of this study is therefore concerned with a survey of some popular web development technologies by embarking on an intensive evaluation exercise. Some evaluation techniques were adopted and implemented on each of the selected technologies by using both primary and secondary data. A wide range of interview was conducted, an empirical approach also used to evaluate the Web development tools using some decision variables such as Platform, Speed of execution, Database supports, Program length etc. A usability study was embarked through the use of the distribution of structured questionnaires to target respondents which include experienced programmers, Web designers, Computer IT training Institutions with carefully selected experimental. The data were statistically analysed with the use of Mean Comparison of Web Technologies against the variable matrices and useful results were derived.

It was apparent from the outcome of the result that the productivity of software is partially determined by such factor as web development tools, machine speed, and other factors.

Keywords: Web Technology, Browsers, Internet, Primary and Secondary data.

1. INTRODUCTION

The internet and the World Wide Web as it stands today is a magnificent success, as an informational superhighway aimed at stifling the limitations of conventional communication means, and of allowing the communication between humans and machines. It has fast become a fundamental source of information to almost every facet of life, and as a cradle of learning, research, recreation [5]. The main goals of evaluation are to assess the application functionality, to verify the effect of its interface on the user, and to identify any specific problem with the application, such as aspects which show unexpected effects when used in their intended context [17].

Evaluating Web applications in particular entails verifying if the application design allows users to easily retrieve and browse contents, and invoke available services and operations. This therefore implies not only having appropriate contents and services available into the application, but also making them easily reachable by users through appropriate hypertexts. The interest of this research is to explore some of the popular Web development tools that are mostly used by web developers in Nigeria.

1.1 Background To Research Study

The Internet is no longer merely an e-mail and file-sharing system as it was originally intended, but rather has emerged as a prevailing interactive standard. It has grown to be an integral part of the ever-escalating large-scale media system, moving into center stage of media politics alongside traditional broadcast media television and radio. All the credits to the technology of the World Wide Web which has now become a major delivery platform for web development a variety of complex and sophisticated enterprise applications in several domains. These web applications exhibit complex behavior and place some unique demands on their usability, performance, security and ability to grow and evolve. However, a vast majority of these applications continue to be developed in an ad-hoc way, contributing to problems of usability, maintainability, quality and reliability[18].

1.2 Statement Of The Problem

As the technology of the web expands, its social recognition and audience grows. The challenges of the web developers remains as it has been for years, to value and significance to the online medium. Professionally developed websites involve major investment of talents and resources.
The people funding this works naturally begin to enquire what kind of returns they are getting as very few of them have much of a feel for their reimbursement on this venture. Much of that has been due to the incredible hype and fast growth surrounding this technology, combined with the low cost of experimentation with the latest and emerging sophisticated Web development tools or technologies available in the software market that suit their need.

Since software engineering techniques have not progressed at a sufficiently rapid pace to cover the specifics of web application and to cope with upcoming technologies, any new ideas and discoveries are never wholly accepted without subjecting them to some criteria through research work. Web design and maintenance are likely to absorb more and more resources as web technologies and users keep evolving at an alarming rate.

1.3 Study Objectives
This research work evaluated some web development technologies. Therefore the investigation carried out on the following specific areas:

i. Identify personal characteristics of the respondents and the extent of knowledge about web development tools
ii. Access the perceived usability of the given tools over some period of time
iii. Identify the most preferred tools in the study areas

2. RELATED LITERATURE
Web development tools are failing to address users’ needs despite the promises made by vendors. Users are presented with the opportunity of using the Web to decrease overheads associated with client/server applications, to create new sales channels and facilitate the information flow between customers and suppliers[15]. The Web development tools market is immature, with many different methods and approaches on offer, and several conflicting standards. However, the market has no clear leader, and there are inadequate products for medium or large-scale development projects [19].

Also evaluated a wide cross-section of Web Development Tools based on Vendors’ approach by taking a critical scrutiny of eight most popular vendors’ such as: Netscape, Oracle, IBM, Vision Software, Passport Corp, Sybase, Intelligent Environments, Microsoft using some identified issues such as scalability, application adaptability, deployment flexibility, Change-cycle support, platform compatibility, and database compatibility. He explains the strengths and weaknesses of each. He concluded that, it saves you time and money selecting the right strategy and tool.

The main deficiencies in web development tools are that they cannot support teams of developers working together and are incapable of building flexible applications that can be adapted to meet the changing business and technology requirements of different organisations [8],[19]. According to [9],[18],Web development tools evolve extremely fast, enabling sophisticated tools to be deployed and complex interactions to take place. It is a well known fact that the average quality of Web sites is poor due to “lack of sophisticated Web development technologies that enhances the dynamic and interactivity of Web pages being the main cause of user dissatisfaction”.

Other citations on web developments could be seen in the works of [10],[11],[21],[22],[23]. Thus, Web development technologies quality can be defined (ISO9126) as “the totality of features and characteristics of a software product that bear on its ability to satisfy stated or implied needs” such as robustness, reliability, maintainability, and usability as the main significant factors. Also, usability can be defined (ISO9241) as “the effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments”[16].

2.1 Web technologies
Web technologies are the programming languages, document display principles and services existing when using the Web to relate with the Internet.

2.1.1 The Types of Web Technology
Several scores of web technologies are handy today. Ranging from communication services to analysis tools for business marketing. Some of the key technologies that allow us to explore the Internet are as follows:

- Markup languages
- Web services
- Web analytics

2.1.2 Markup Languages
Markup languages are a standard coding or language interpreted by Internet browsers. They are designed to allow you create electronic documents that are most commonly formatted for display on the computer screen in a Web browser. One of the most popular markup languages is Hyper Text Markup Language, or HTML. This language was developed in 1990 by Tim Berners-Lee.

Other examples of markup languages include the following:
- Extensible Markup Language (XML)
- Extensible HTML (XHML)
XHTML is HTML as defined through XML (Extensible Markup Language). XML allows programmers who understand it to write their own markup commands, or modify current ones, increasing the flexibility of a language such as XHTML[8].

### 2.1.3 Web Services

Web services make the Internet a vibrant place. They services enables devices, such as computers and mobile equipments, to communicate over the Web. Many services are provided in an obscure way to the user. For example, online storage and other services are offered as a background work by cloud computing.

### 2.1.4 Web Analytics

Web analytics involves the collection of complex data from an Internet domain name and twisted into reports by the domain owner. The reports provide detailed information about a number of events. For example, Online auction-sites such as eBay may use web analytics to determine which part of a website results in the most sales.

### 2.2 Web development

Web development is an extensive term for the process of creating a web site for the Internet (World Wide Web) or an intranet (a private network). This can include web design, web content development, client liaison, client-side/server-side scripting, web server and network security configuration, and e-commerce development.

#### 2.2.1 Some selected web development tools

**PHP** is an open-source, cross-platform, object-based scripting language for vibrant Web applications that is equivalent to ASP. Versions of PHP run on numerous operating systems and Web servers, and interfaces are available in many database systems. PHP is available for Windows operating systems, but since ASP being commonly the preferred alternative on Windows systems, PHP is most prevalent on Linux systems running Apache.

**HTML** stands for Hyper Text Markup Language, founded in 1980 by Tim Berners-lee. It provides a means to create structured documents by denoting structural semantics for formatting documents. It enables images and objects to be embedded and can be used to create interactive forms. It is written in the form of HTML elements consisting of "tags" surrounded by angle brackets within the web page content [15].

**FrontPage** Microsoft Front Page is a web page authoring tool designed to fully integrate page editing, site management, reporting, and publishing within the same application. Front Page is what is known as a WYSIWYG ("what you see is what you get") editor, much like other editors like Dreamweaver or Composer, which allows you to forego actual coding and simply design WebPages within the document window. Front Page offers many unique functions and features not available in other web authoring tools. However, it is important to remember that some of these functions will only work when your website has been uploaded to a server that supports Microsoft Front Page server extensions.

**Dreamweaver** Adobe Dreamweaver is a web development tool originally owned by Macromedia. It supports CSS, JavaScript, and a number of other web-related technologies. It combines HTML and CSS plain text editing with a WYSIWYG tool which lets you check progress as you go or edit WYSIWYG on the fly. It’s the industry standard tool for this sort of thing, although there are many, many programs which do more-or-less the same thing. CGI. Dreamweaver is not designed to completely remove the agency of HTML and CSS: it is meant to assist you with your HTML and CSS and to make some of the more mundane aspects of Web Publishing less terrible[22].

**CGI** stands for Common Gateway Interface. Similar to ASP and PHP, CGI is used for server-side processing for Web applications. Because CGI is designed to be server-agnostic, you can develop CGI applications that run on Windows, UNIX, Macintosh, or other server operating systems. You can write CGI applications in C, C++, Java, and Perl. ASP is an alternative to traditional CGI programming.

**ColdFusion** was introduced in 1995 by Allaire Corporation as an “easy to program” technology for designing and creating dynamic content. The vital feature of the technology is the template-based ColdFusion Markup Language (CFML), originally interpreted but now JIT-compiled into servlets. It is a scripting language that has been used by developers to create dynamic websites. A dynamic website can alter depending on outside factors like data, user preferences or changes in backend database. Websites that only use HTML are static.

**ASP** is a server-side scripting environment for Web applications that provides a scripting language engine that supports several languages, an object model, and an interface for accessing server components. Although ASP is generally used with VBScript, you can also use ASP with JavaScript. When used with VBScript, you can use ASP for database processing, form processing, and other Web applications that require server interaction, such as sending mail and reading or changing the contents of files that are located on the server.

**XML** The Extensible Markup Language (XML) is a widely accepted markup language that simplifies the transmission of structured data between applications. XML is a meta-language for creating collections of custom elements, in contrast to HTML, which provides a fixed set of elements.
XHTML stands for eXtensible HyperText Markup Language and is a hybrid of HTML and XML. XHTML was created for two main reasons: To create a stricter standard for making web pages, reducing incompatibilities between browsers and to create a standard that can be used on a variety of different devices without changes is a web standard which has been agreed by the W3C and, as it is backwards compatible.

FLASH Macromedia Flash, otherwise called Adobe Flash or Shockwave Flash, is a popular program used in create animations, advertisements, web pages and presentations. It was introduced in 1996. Macromedia Flash contains a scripting language called Action Script. The program Flash was the ingenuity of Jonathan Gay, whose initiative started in college and developed the software while working for Silicon Beach Software. Macromedia Flash itself can create a whole webpage and it is livelier than plain HTML.

With flash the web developer is now able to create a user experience that is rich in media and relatively quick loading, especially compared to traditional methods like GIF animations.

Web Browser
A web browser is a software application for retrieving, presenting, and traversing information resources on the World Wide Web. An information resource is identified by a URL and may be a web page, image, video, or other piece of content.

Primary tasks of a web browser is to Convert web addresses (URL’s) to HTTP requests, Communicate with web servers via HTTP and to finally Render (appropriately display) documents returned by a server. Hyperlinks present in resources enable users to easily navigate their browsers to related resources. Although browsers are primarily intended to access the World Wide Web, they can also be used to access information provided by web servers in private networks or files in file systems. The major web browsers are Windows Internet Explorer, Mozilla Firefox, Apple Safari, Google Chrome, and Opera[6].

A Recent Browser Use Statistics as shown in the figure shows that Chrome and Firefox are the most patronized browser as reflected in the table below:

Table 1: Web Browsers’ User Statistics

<table>
<thead>
<tr>
<th></th>
<th>Internet Explorer</th>
<th>Firefox</th>
<th>Chrome</th>
<th>Safari</th>
<th>Opera</th>
</tr>
</thead>
<tbody>
<tr>
<td>October</td>
<td>16.1 %</td>
<td>31.8 %</td>
<td>44.9 %</td>
<td>4.3 %</td>
<td>2.0 %</td>
</tr>
<tr>
<td>September</td>
<td>16.4 %</td>
<td>32.2 %</td>
<td>44.1 %</td>
<td>4.2 %</td>
<td>2.1 %</td>
</tr>
<tr>
<td>August</td>
<td>16.2 %</td>
<td>32.8 %</td>
<td>43.7 %</td>
<td>4.0 %</td>
<td>2.2 %</td>
</tr>
<tr>
<td>July</td>
<td>16.3 %</td>
<td>33.7 %</td>
<td>42.9 %</td>
<td>3.9 %</td>
<td>2.1 %</td>
</tr>
<tr>
<td>June</td>
<td>16.7 %</td>
<td>34.4 %</td>
<td>41.7 %</td>
<td>4.1 %</td>
<td>2.2 %</td>
</tr>
<tr>
<td>May</td>
<td>18.1 %</td>
<td>35.2 %</td>
<td>39.3 %</td>
<td>4.3 %</td>
<td>2.2 %</td>
</tr>
<tr>
<td>April</td>
<td>18.3 %</td>
<td>35.8 %</td>
<td>38.3 %</td>
<td>4.5 %</td>
<td>2.3 %</td>
</tr>
<tr>
<td>March</td>
<td>18.9 %</td>
<td>36.3 %</td>
<td>37.3 %</td>
<td>4.4 %</td>
<td>2.3 %</td>
</tr>
<tr>
<td>February</td>
<td>19.5 %</td>
<td>36.6 %</td>
<td>36.3 %</td>
<td>4.5 %</td>
<td>2.3 %</td>
</tr>
<tr>
<td>January</td>
<td>20.1 %</td>
<td>37.1 %</td>
<td>35.3 %</td>
<td>4.3 %</td>
<td>2.4 %</td>
</tr>
</tbody>
</table>

Data Source: W3Schools.com

Client/Server side Scripting
Client side coding such as XHTML is executed and stored on a local client (in a web browser) whereas server side code is not available to a client and is executed on a web server which generates the appropriate XHTML which is then sent to the client.

How they Communicate
Initial Client Request: The HTTP client sends a request message formatted according to the rules of the HTTP standard. This message specifies the resource that the client wishes to retrieve, or includes information to be provided to the server. Response by Server: The server reads and interprets the request. It takes action relevant to the request and creates an HTTP Response message, which it sends back to the client. The response message indicates whether the request was successful, and may also contain the content of the resource that the client requested, if necessary.
Web-Server
The term web server or webserver can mean one of two things: A computer program that is responsible for accepting HTTP requests from clients (user agents such as web browsers), and serving them HTTP responses along with optional data contents, which usually are web pages such as HTML documents and linked objects (images, etc.). Or a computer that runs a computer program as described above. Its basic responsibility is to Receive HTTP request via TCP, Map Host header to specific virtual host(one of many host names sharing an IP address), Map Request-URI to specific resource associated with the virtual host and return the HTTP request and response. A recent browser statistic is shown if fig 2

3. METHODOLOGY
Depending on the phase in which evaluation is performed, it is possible to distinguish between formative evaluation, which takes place during design, and summative evaluation, which takes place after the product has been developed, or even when any prototype version is ready. During the early design stages the goal of the formative evaluation is to check the design team understanding of the users’ requirements, and to test design choices quickly and informally, thus providing feedback to the design activities. Later on, the summative evaluation can support the detection of users’ difficulties, and the improvement and the upgrading of the product. [17].

We adopted the empirical approach to evaluate the Web development tools. In trying make a fair judgement in coding, compiling / interpreting and running programs in each Web tools, a sample web page was designed and tested against each variable. The Web development technologies considered include: PHP, HTML, MS-FrontPage, VBScript, Active Server Page, JavaScript, Macromedia Dreamweaver, Macromedia ColdFusion, XML, Macromedia Flash, jQuery. A usability study was also deployed in the research which involved the design and distribution of structured questionnaires to target respondents.

Our target respondents include experienced programmers, Web designers, Computer IT training Institutions etc. A statistical analysis was done on the data using the Mean Comparison which gives a better result than a mere Percentage analysis used by some researchers. The decision variables used are as follows:
- Database supports
- Portability
- Program length
- Speed of execution
- Platform

The choice of the decision variables is guided by the fact that the speed of a technology is highly dependent on the chosen variables.

Table 2: Demographic status of the respondents.

<table>
<thead>
<tr>
<th>s/n</th>
<th>Personal Characteristic(s)</th>
<th>Freq</th>
<th>Perc (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEX</td>
<td>Male</td>
<td>98</td>
<td>76.5625</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>30</td>
<td>23.4375</td>
</tr>
<tr>
<td>EDU STATUS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSCE</td>
<td></td>
<td>20</td>
<td>15.625</td>
</tr>
<tr>
<td>OND</td>
<td></td>
<td>32</td>
<td>25</td>
</tr>
<tr>
<td>HND</td>
<td></td>
<td>27</td>
<td>21.09375</td>
</tr>
<tr>
<td>NCE</td>
<td></td>
<td>1</td>
<td>0.78125</td>
</tr>
<tr>
<td>1st Degree</td>
<td></td>
<td>37</td>
<td>28.90625</td>
</tr>
<tr>
<td>Masters</td>
<td></td>
<td>11</td>
<td>8.59375</td>
</tr>
<tr>
<td>AGE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td></td>
<td>35</td>
<td>27.34375</td>
</tr>
<tr>
<td>30-39</td>
<td></td>
<td>57</td>
<td>44.53125</td>
</tr>
<tr>
<td>40-49</td>
<td></td>
<td>32</td>
<td>25</td>
</tr>
<tr>
<td>50 And Above</td>
<td></td>
<td>4</td>
<td>3.125</td>
</tr>
<tr>
<td>EMPL STATUS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td></td>
<td>51</td>
<td>39.84375</td>
</tr>
<tr>
<td>Private Sector Empl</td>
<td></td>
<td>65</td>
<td>50.78125</td>
</tr>
<tr>
<td>Civil Servant</td>
<td></td>
<td>12</td>
<td>9.375</td>
</tr>
</tbody>
</table>

The usage frequency of Web development technologies from 128 participants was identified (see Table 3.1). There were 76.5625% male and 23.4375% female respondents. Their educational status 15.625% School certificate holders, 25% Ordinary Level Diploma certificate holders, 21.09375% Higher National Diploma degree holders 0.78125% NCE, 28.90625% have University Degree and 8.59375% have Masters Degree. On the age category, about 27% were in their twenties, 45% in the grade of thirties 25% were in the 40yrs age grade while 3% were above the stated age grades. About 40% were students, 51% in the private sector and only 9% were Civil servants.
4. RESULTS AND FINDINGS

TABLE 3: Mean Comparison of Web Technologies against the variable matrices (speed)

<table>
<thead>
<tr>
<th>VARIABLES * TECHNOLOGIES Cross tabulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count</td>
</tr>
<tr>
<td>TECHNOLOGIES</td>
</tr>
<tr>
<td>Means</td>
</tr>
<tr>
<td>PHP</td>
</tr>
<tr>
<td>PF</td>
</tr>
<tr>
<td>SE</td>
</tr>
<tr>
<td>PL</td>
</tr>
<tr>
<td>DB</td>
</tr>
<tr>
<td>PORT</td>
</tr>
<tr>
<td>Means</td>
</tr>
</tbody>
</table>

Note: Figures followed by the same letter are statistically not significantly different at 5% significant level according to Least Significant Different (LSD) Test.

The table above shows that there is no significant difference in the overall comparison of the development technologies. However, PHP, FLASH, FrontPage, XML, VBScript have the high execution speed. PHP, CF, JVSC, XML are favoured in terms of portability. PHP, JVSC, XML, FLASH, PHP have the less dependent on the platforms. PHP ASP JVSC XML all have high support for database.

Figure 2: Graph of Technologies Against Mean Values.
4.1 Result Discussion:
From the chart of Mean Comparison of Web Technologies against the variable matrices the following deductions are made; PHP, FrontPage, HTHL, have great execution speed. Front Page, Dreamweaver, Macromedia Flash exhibit low tendency to support vast databases. Almost all the technologies show relative high level of portability. In terms of program length, HTML, Coldfusion, ASP, VBScript HML have longer lines of codes as compared to the others.

Now, a comparison of the result from Table1 and figure1 clearly shows that the preferred tools in terms of speed are PHP,XML,ASP.

5. SUMMARY OF FINDINGS:
It is observed from the findings that a great deal of web application development is vastly motivated by technology drive in high speed inventive scenery. Corresponding with the shifts in importance of the web applications developed, we anticipate a shift towards extra technology driven approaches where needs, requirements, and high quality becomes fundamental. However, despite the fact from our findings that there is no significant difference in the overall comparison of the development technologies when all the factors are taken into consideration, there are still significant differences in variables when independently considered which brings us to the following:

- If you are designing generally with no specific interest in a particular variable, choose any technology that you are most familiar with.
- If your application needs support for vast database, then PHP, ASP, JVSC, XML,VBSC would be a better choice.
- PHP FP, VBSC, XML, FLASH all showed remarkable speed in execution and as such would be ideal for designers with heavy sites that desire fast execution/display of their web sites.
- JVSC, XML, FLASH, PHP have the less dependent on the platforms. So it would be a good choice if the designer needs the application to run on different platforms.

6. CONCLUSION
From our research, we observed that web-applications are to some extent still developed as if they were common tool mainly used for publishing information. The significance of careful considerations of design and architectural choices needs to be understood by the involved parties, communicated by the key actors in the actual development efforts in getting well acceptable design. Hence, a main challenge for headway of web application is a complete transformation in the applied practices.

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References:


