Technium Vol. 8, pp.84-99 (2023)
ISSN: 2668-778X
www.techniumscience.com

QUALITY AND PERFORMANCE EVALUATION METRICS OF WEBSITES : A SYSTEMATIC LITERATURE REVIEW

Abdullah AL DULAIMI * , Dr.*Shayma AL- MASHHADANY* *

*** Department of Computer Science, College of Computer Science and Mathematics, University of Mosul, Nineveh, Iraq, abdallah.20csp79@student.uomosul.edu.iq , shaymamustafa@uomosul.edu.iq**

Abstract

Background *- Websites play an important role in government, educational and commercial organizations. In the field of education, using websites of universities has been increased and because of that it has been importance to ensure that the universities have an effective websites. Various metrics have been used to evaluate the quality of websites. All these metrics affect the performance and quality of website .*

Objectives *- This paper presented a systematic literature review SLR to get an overview about the current studies of distinct criteria for evaluating the websites and each criteria is explored briefly to give the basic idea behind it. In general, the paper's objective is to give an up-to-date introduction and short review of these criteria .*

Methods *– A Systematic literature review is implemented according to the guidelines of performing a SLR in software engineering. The study was based on a comprehensive set of papers gathered from the online libraries published within time span 2010 to 2022 .*

Conclusions *- The results from this SLR include information about the criteria for evaluating the quality and performance of the multi-level web according to previous research, which was divided into applicable sub-criteria, and then the latter was divided into measurable indicators. within a specific period that can help researchers in this field through providing an overview of the current researches in this area. Furthermore, it may serve as a first step towards a great explanation of the topic with the help of SLR .*

Keywords : Websites Quality Evaluation, Quality Metrics ,Performance Indicators , Performance Evaluation

1. INTRODUCTION

A large number of new websites have been created every day. The websites which have same contents will not have the same quality degree. If the website has poor quality, this make the user leave the website simply and go elsewhere, and there is no chance to get user back to the website once again. Therefore, in order to improve the website quality, it is important to create the website with some properties such as: gainful, useable, available, useful and give reliable information that providing a good design and graphical form to meet the requirements and expectations of the users. This can be done through defining the website criteria, the quality of website depends on some measurable metrics that providing an effective to develop the performance of the website. However, the quality evaluation process became a challenge of the new websites. Generally, the quality evaluation

Technium Vol. 8, pp.84-99 (2023)
ISSN: 2668-778X
www.techniumscience.com

process of website became an essentially valuable topic and continuously in development , especially in the field of websites quality metrics (Liburne et al., 2004). Several metrics have been developed for measuring the quality of websites, which include structure, usability, multimedia, reliability, performance, and efficiency as shown in Table (1). these metrics have been divided into several applicable sub-metrics and then the latter is divided into measurable indicators, where these indicators have obtained high percentages that make them usable in design the website.

This paper provides a systematic literature review to present a broad overview of the primary studies on evaluating the quality of websites since 2010. The motivation is the identification of the evidence available on the topic and identification of the research gap in evaluating the quality metrics. Following the introduction, the structure of this paper is as follows:

Section 1.2 includes the systematic literature review framework, Section 1.3 contains the discussion of the research questions that explain the website quality metrics, and the Evaluation Calculation, while the conclusions presented in section 1.4 .

Table.1. Website Quality Metrics Overview

Metrics	Second Level	Third level
Structure	Standard Table and Resolution	Standard Table Size
		Optimize the Page Resolution
	Pictures	Definite Picture Size
		Large Picture in One Page
		ALT of Picture
		Link of Picture
	Color	Using Multiple Colors
		Using Safe Colors
		Limitations of Colors
Usability	Consistency	Css Attributes
	Annotation	Label and Caption for Link
		Description of META
	Navigation	Navigation Menu Bar
		Link to Home
		Frames Validity
Multimedia	Multimedia Metrics	Attributes of Multimedia components
		One Media in one page
		Using Thumbnails
		Plug in Support
Dependability	Dependability Metrics	Web Traffic
		Domain Name
		Information publicity
		Customer Feedback
Performance	Performance Metrics	Download speed
		Response time
		Optical stability
Efficiency	Efficiency Metrics	Information Guide
		Avoiding Auto refresh
		Search Engine
		Bulletin Boards

Technium Vol. 8, pp.84-99 (2023)
ISSN: 2668-778X
www.techniumscience.com

2. Systematic Literature Review Framework

The process of selecting and categorizing research from as much current literature as is relevant to an interest issue is known as a systematic literature review. When applied to a particular topic, it frequently produced a summary and a map of its findings by categorizing various research report types according to numerous dimensions. These investigations have primarily been suggested for research fields with very broad topics and little relevant information discovered during primary domain studies. When doing a coarse-grained review, the only goals are to locate and identify relevant evidence for research questions and to spot any knowledge gaps that can inform future study (Feldt et al., 2008). In this study, a systematic mapping study of website quality metrics have been conducted, since it seems to be a broad topic with various researches focus fields. However, no existing research has conducted a systematic literature review of this area. This section characterizes the review protocol that include the fundamental process of defining the research questions, defining the strategy of search, selecting of previous studies, and systematic map .

2.1. Research Questions

The goal of this study is to get a presentation and an overview of the current researches in the area of quality website evaluation metrics by the following questions. The overall goal is defined in these research questions :

RQ. 1 what are the different metrics used in evaluation the quality of websites?

RQ. 2 Which is the most widely used metric that affect the quality?

RQ. 3 What are the Website Quality Metrics and their indicators?

RQ. 4 How to evaluate the website quality?

2.2. Sources Of Information

This paper presents a systematic review of the work done in the field of website quality metrics and in order to get a broad view, various papers and journals have been searched and selected the publications that related to this study within the time span 2010 to 2022. After selecting the publications related to the study within this period, 34 articles have been found that very closely to the website quality metrics .

3. Discussion of the Research Questions

This section discusses the answers from the researches that described the research questions .

3.1. Research question 1: what are the different metrics used in evaluation the quality of websites?

The criteria of evaluating the quality of website were presented in Table 1, these criteria were collected after a comprehensive study of the previous researches stated in table (2), that presents a group of previous research specialized in evaluating the performance and quality of websites within the period from 2010 to 2022 where the metrics used in each research were determined .

The Utilization weight of the previous studies has been is calculated for each criterion, based on the percentages gained by the evaluation criteria from prior studies. The number of studies for each metric and the percentages of these criteria are displayed in Table (3).

Table .2. Website Quality Metrics Based On The Previous Researches

Seq.	Research	Structure	Usability	Multimedia	Dependability	Performance	Efficiency
1	(Robin ,2022)	✓	×	✓	×	✓	×
2	(Bhargava ,2022)	✓	×	✓	×	✓	×
3	(Mikaela , 2021)	✓	✓	✓	✓	✓	×
4	(Matias , 2020)	✓	×	✓	×	✓	×
5	(Divya,2019)	✓	×	✓	✓	✓	×
6	(Lea & Daniel, 2019)	×	✓	×	×	✓	✓
7	(Seppo , 2018)	×	✓	×	×	✓	×
8	(Seyed , 2018)	✓	✓	×	✓	✓	✓
9	(Eyad , 2017)	✓	×	✓	×	✓	×
10	(Mahmoud & Siham , 2017)	✓	✓	✓	✓	✓	×
11	(David , 2017)	×	✓	×	×	✓	×
12	(Forsythe , 2016)	×	×	×	✓	✓	✓
13	(Dalal , 2016)	✓	✓	✓	×	✓	×
14	(Jeff , 2016)	✓	✓	✓	✓	✓	×
15	(Juan , 2016)	✓	×	×	×	×	×
16	(Shafquat , 2016)	✓	×	✓	×	×	✓
17	(Sarvesh , 2015)	✓	✓	✓	×	×	✓
18	(RAN , 2015)	✓	✓	✓	×	✓	×
19	(Erduan , 2015)	✓	×	✓	×	×	×
20	(Ayeh , 2015)	✓	✓	✓	✓	✓	✓
21	(Ayeh , 2014)	×	✓	×	×	✓	×
22	(Salla , 2014)	×	✓	×	×	×	×
23	(Korvald , 2014)	×	✓	×	×	×	×
24	(Ahmed , 2014)	✓	✓	✓	×	✓	✓
25	(Alisa , 2013)	×	✓	×	×	✓	×
26	(Hundley ,2012)	✓	×	✓	×	×	×
27	(Vladimir ,2011)	✓	×	✓	✓	✓	✓
28	(Abdulhadi ,2011)	×	✓	×	×	✓	×
29	(Bader ,2011)	×	✓	×	×	×	×
30	(Paul , 2010)	×	✓	×	×	✓	×
31	(Laheeb et al.,2010)	✓	✓	✓	✓	✓	✓
32	(Firas , 2010)	✓	✓	✓	×	×	✓
33	(Ahmad,2010)	✓	✓	✓	✓	×	✓
34	(Zihou , 2010)	✓	✓	✓	✓	✓	✓

Table .3. Metrics & References

Metrics	References	Utilization rate
Structure	(1…5 , 8…10 , 13…20 , 24 , 26 , 27, 31…34)	67.647 %
Usability	(3, 6…8 , 10 , 12…14 , 18 , 20…25 , 29…34)	61.764 %
Multimedia	(1…5 , 9 , 10 , 13 , 14 , 16…20 , 24 , 26 , 27 , 31…34)	61.764 %
Dependability	(3 , 5 , 8 , 10 , 12 , 14 , 20 , 27 , 31 , 33 , 34)	32.352 %
Performance	(1…14 , 17 , 18 , 20 , 21 , 24 , 25 , 27 , 28 , 30 , 31)	70.588 %
Efficiency	(6 , 8 , 12 , 16 , 17 , 20 , 24 , 27 , 31…34)	35.294 %

Technium Vol. 8, pp.84-99 (2023)
ISSN: 2668-778X
www.techniumscience.com

These metrics could be characterized as follows :

Structure - means demonstrate that the site is designed in the most attractive manner to draw in beneficiaries and encourage them to stay there for the longest amount of time and return back (Li et al., 2008). This criterion's degree of evaluation is estimated at 20 percent as shown in table (3), and it is one of the key components of the evaluation process because it obtained an estimated use rate of (67.647 percent) as shown in Fig.(1) that shows the relative percentages of each metric depending on the previous studies .

Usability - refers to how easy it is for users to find the information they need on the website, regardless of their level of expertise, and how quickly they can complete tasks with the least amount of effort, which encourages them to return (Quesenbery ,2001) ,This raises the website's value and results in an estimated usage rate of (61.764) among users as shown in Fig. (1).

Multimedia -This criterion has an estimated evaluation degree of 19 percent and is one of the key components of the review process since it directly affects performance. It comprises photographs, videos, and other types of media that included in the website (Gibbs ,1995), and it has an estimated usage rate of (61.764 percent) as shown in Fig.(1) .

Dependability - means a quality standard that the site has as (reliable, safe and secure) ,(Cao et al.,,2009). according to estimates, the evaluation score for this standard is 10%, in addition, it has achieved an estimated usage rate of (32.352%) as shown in Fig.(1) .

Performance - One of the most significant factors in the evaluation process is performance, It covers download speed, reaction time, stability of the display, and presentation time (Online,2022). which has an estimated evaluation degree of 21%. and it now has a predicted utilization rate of (70.588 percent) of the previous works as shown in Fig.(1).

Efficiency - This criterion's anticipated evaluation rate is 11% as shown in table 3, and it refers to the site's capacity for effective and efficient use of the resources at its disposal to provide rich content (De Jong et al., 2009). and it now has a predicted utilization rate of (35.294 percent) as shown in Fig.(1) .

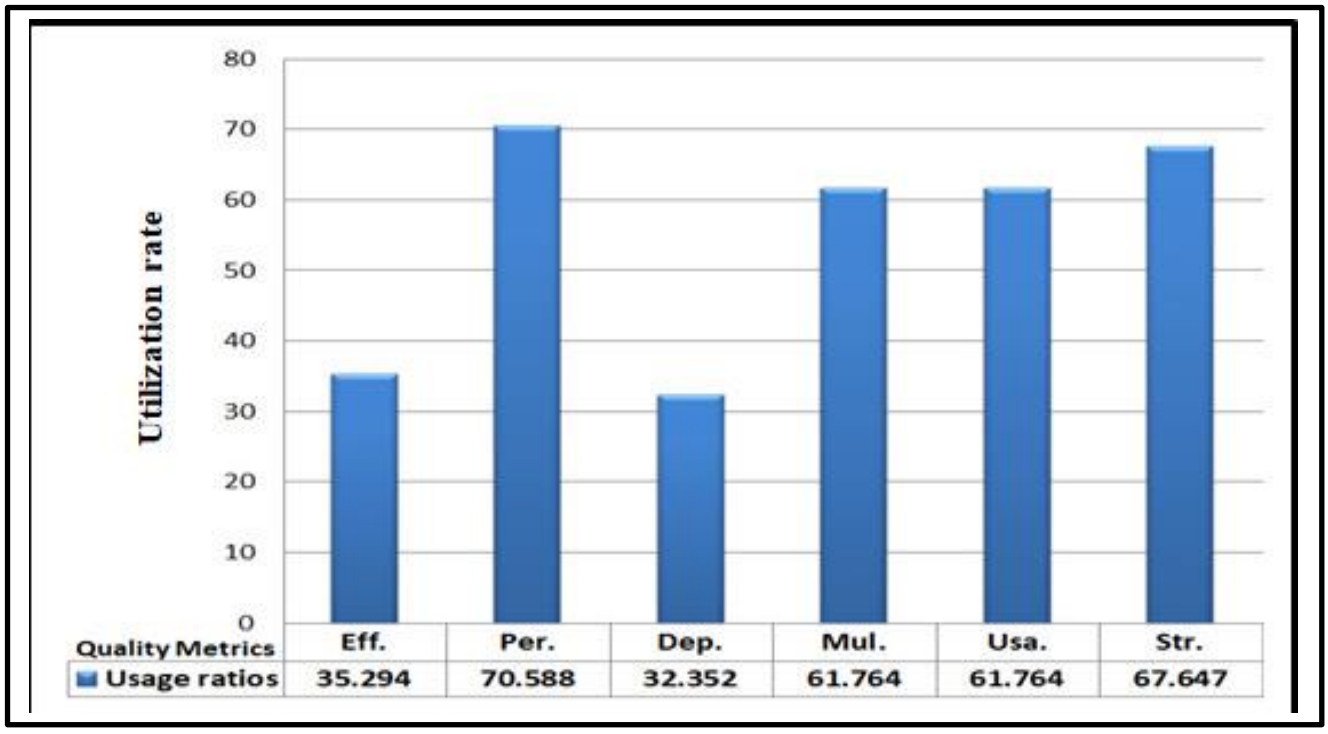


Fig.1. Evaluation Metrics Percentages Based On Previous Studies

Technium Vol. 8, pp.84-99 (2023)
ISSN: 2668-778X
www.techniumscience.com

The appropriate weight for each quality criterion is determined through the usage indicator for each criterion by previous research shown in Fig.(1),where it is represented by a percentage indicating its importance as shown in Fig.(2) .

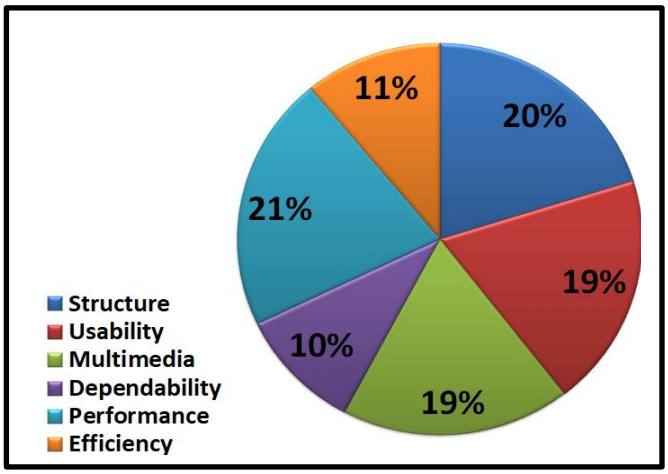


Fig.2. Quality Metrics Percentages Based On Previous Studies

3.2. Research Question 2 Which is the most widely used metric that affect the quality?

In this study, earlier research's on evaluating the effectiveness and quality of websites was studied in order to identify the most popular metrics that listed in Table(1). These researches were selected from journals and theses. Table(3) shows that (structure , usability, multimedia, and performance) received the greatest percentages of the previous works, demonstrating the significance of its use. The systematic map of the quality metrics is illustrated using summary statistics which showing the frequencies of publications in each category. In this study a bubble plot has been used to report the frequencies shown in Fig.(3), each bubble contains the number of researches that have been focused on in different years within the period 2010 to 2022. The bubble plot is more powerful in giving a quick overview of a field, and thus to provide a map. From the Fig.(3), it seems that the performance criterion metric that influence quality, such as structure, have been employed most frequently.

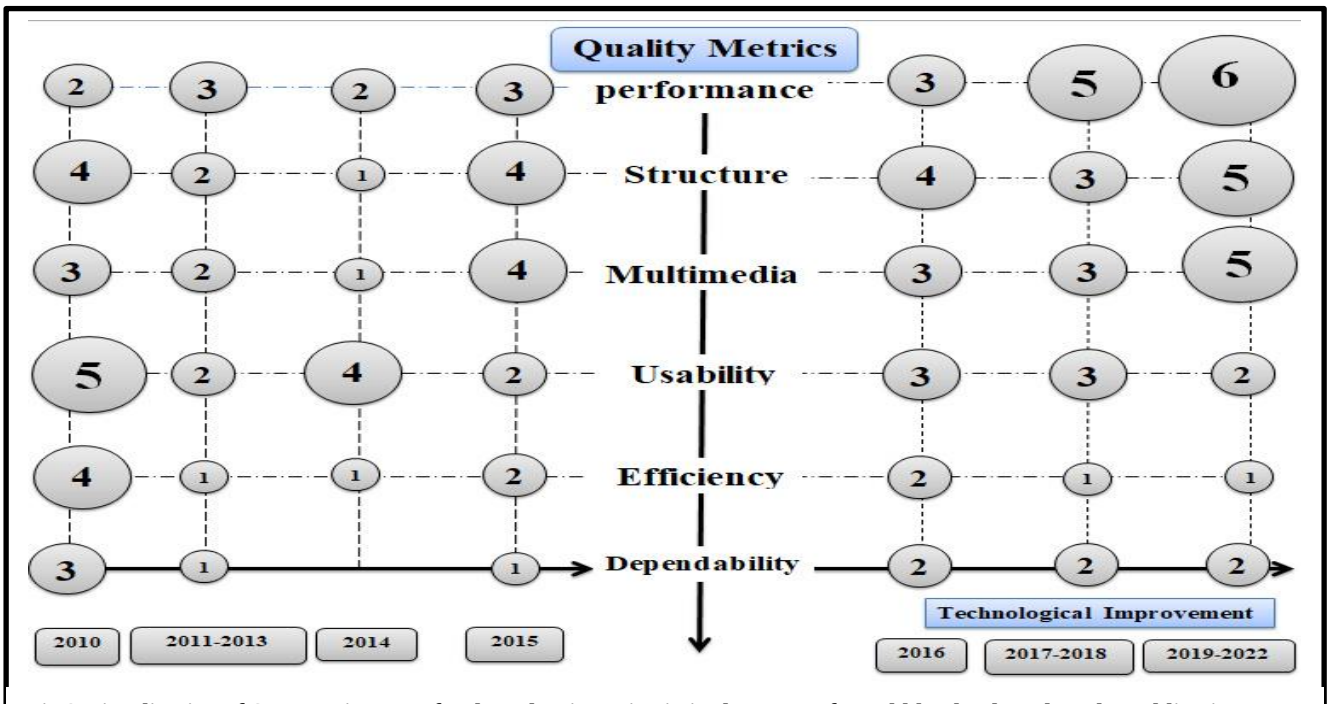


Fig.3.Visualization of Systematic Map of web evaluation criteria in the Form of a Bubble Plot based on the publication years

Technium Vol. 8, pp.84-99 (2023)
ISSN: 2668-778X
www.techniumscience.com

3.3. Research Question 3: What Are The Website Quality Metrics And Their Indicators ?

After a comprehensive study of a group of specialized researches in evaluating the quality and performance of the site and within the ratios mentioned in Table (3), the following criteria were selected in the process of evaluating the quality of the web, which include: (Structure , Usability, Multimedia, Dependability, performance , and Efficiency). These metrics will be explained in details in the next sections .

3.3.1. Structure Metrics

The Website Design Scale is a thorough assessment tool for website design. It contains two levels, each of which has sub-properties. By categorizing their visual effects on a website as colors, Pictures, table size, and page resolution, sub-properties are formed by treating them as a set of criteria. This includes designing with user frames, tables, and fonts without confusing them with complex colors or layout when they appear on websites, as in User interface (Li et al., 2008). For more clearly, during the analysis and programming stages, the sub-characteristics are analyzed and the results are in the binary system (0,1). Next, the result is added together, divided by the number of indicators, and multiplied by a specified weight (where the weight is determined by the importance of the criterion or indicator), Thus, the outcomes of the second level are added together in percentage, and a review of the site's design structure will be conducted, as indicated in Fig.(4). According to the statistics from several prior studies shown in Table (3). it was discovered that the criterion of the site's design structure received high ratings due to its significance and impact on the user as shown in Fig.(5) that highlights the significance of using the design criterion .

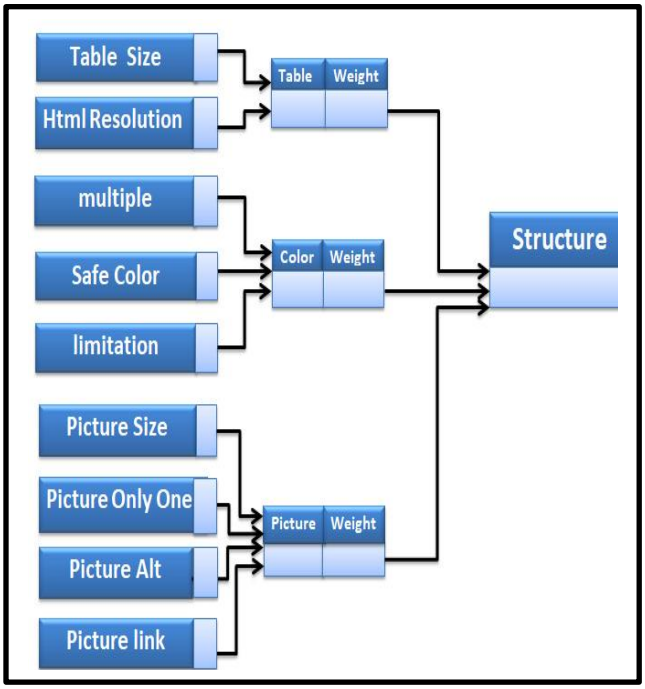


Fig.4. The Indicators of Structure

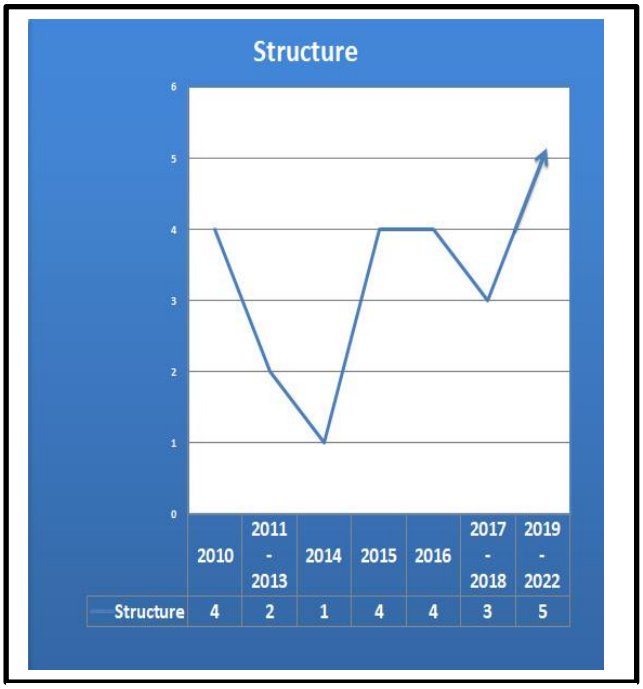


Fig.5. Technological advances of Structure criterion

The sub-properties of Structure criterion are :

3.3.1.1. Pictures

The elements of a web page that are most easily noticed are the pictures. They include (JPEG) and (GIF), as well as several formats like (BMP, TIFF, PNG, etc.), (Miano ,1999). Websites frequently have intricate graphics, including animations and other special effects. The scale quality that characterizes graphics therefore does not enhance the page's aesthetic design .

Technium Vol. 8, pp.84-99 (2023)
ISSN: 2668-778X
www.techniumscience.com

3.3.1.2. Standard Table Size and Page's Resolution

A key aspect of the web interface's quality is the website design. In order to evaluate the site design, it was utilized to establish the typical table size and page resolution. Modern websites demand that the site's home page design be the same across all browsers in order to ensure that it provides similar table and text sizes and accuracy on all pages, whereas traditional websites have forced their appearance through a number of dissimilar browsers as an example of how to change the site architecture (Tractinsky et al.,1997).

3.3.1.3. Color

Visually appealing web sites require a consistent and reasonably visually acceptable color scheme because color is one of the most obvious cues for a website user. For the website to appear in good quality, the color scheme needs to be harmonious and consistent. Without color, the page might look empty from an aesthetic standpoint. Because of this, a high-quality website should have a coherent and well-balanced color palette. Background colors are typically shown when a website is opened before the content does (Knutson , 1997) .The page seems jumbled when there are too many colors or inconsistent color patterns. As a result, determining color quality can be exceedingly challenging .

3.3.2. Usability Metrics

According to data presented in the search for a number of earlier studies shown in Table (3). a standard ease of use on a large proportion of his importance and its impact on the user, It defined as "the capacity to comprehend user requirements, formulate distinct goals, and in the finest standards of assessment criteria" (Quesenbery, 2001).Usability is divided into three sub-properties as shown in Fig.(6), each of which is a quantifiable indicator (Consistency ,Navigation, and Annotation).These indicators have been chosen because they are more practical for users to use computer interfaces, as well as to analyze effective websites where users can quickly and effectively access the necessary pieces of information on the site, and more. This makes it possible to calculate the quality of use well, indicating a formula by measuring the assembly of these sub-properties. Additionally, a specific weighting for each of them is assigned in accordance with the significance and enthusiasm of researchers for each quantifiable measure. Briefly, during the programming and analysis stage, the sub-characteristics are analyzed, and the results are in the binary system (0,1); after that, the product is gathered, divided by its number, and multiplied by weight , as a result, the results of the second level are gathered in percentage; and finally, we have a usability rating for the website. Fig.(7) illustrate the extent to which earlier research used this criterion .

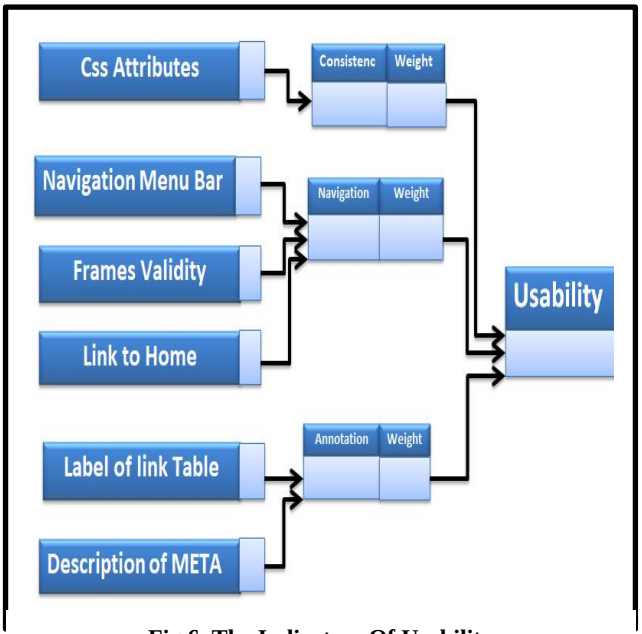


Fig.6. The Indicators Of Usability

Fig.7. Technological Advances OF Usability Criterion

Technium Vol. 8, pp.84-99 (2023)
ISSN: 2668-778X
www.techniumscience.com

The sub-properties of Usability criterion are :

3.3.2.1. Consistency

People need uniformity in website design so they can find stuff more quickly. All pages must have consistent user interfaces that present the same options in the same way across the entire website if consistency is to be described as individuals being able to explore a website from page to page and find similar content or information presented in similar ways to the previous one. It is simpler and more user-friendly because of the clear consistency that keeps the same design aesthetic throughout the entire page (Quesenbery, 2001) .

3.3.2.2. Navigation

Navigation is the process of transforming from one page to another within a website is known as website navigation, and it is one of the key elements. Therefore, navigation is crucial since it establishes the flow for website users to navigate the site. It is one of the essential components that work together to produce an excellent website. A good website makes it simple for visitors to obtain the content they need; but, if the navigation is poorly designed, it may make consumers reluctant to return to the site (Quesenbery, 2001) .

3.3.2.3. Annotation

This indicator consists of (tag , caption , label , summary, etc.). Annotations are typically used in newspapers or periodicals, although they can also be important in many aspects within a website's domain. An assembly of text characteristics for a website's primary element might be referred to as an annotation. Annotations that are clearly defined can enable user access behaviors, help users comprehend a website's functioning, and let users see what they enjoy. (Quesenbery, 2001) This study suggests that websites should include annotations for every element that includes links, forms, tables, images, etc.

3.3.3. Multimedia Metrics

According to the statistics of a number of researches shown in Table (3),it was found that the site's multimedia metric received good ratings (61.764 - percent). The direct impact of online multimedia on performance has led to increased interest in it. To evaluate multimedia, it is necessary to classify components as essential, carefully select quality criteria, and define each characteristic by illustrating a particular value of online multimedia that meets the needs of site visitors as shown in Fig.(8). Multimedia is a high-quality asset that can be calculated using the aggregation technique directly from quantifiable indicators. The main objective of multimedia evaluation is to effectively demonstrate the level of multimedia quality in the live site, without compromising performance at the same time. Important indicators are considered through weights, and Fig.(9) shows the rate of use of this criterion for previous years (Gibbs , 1995) .

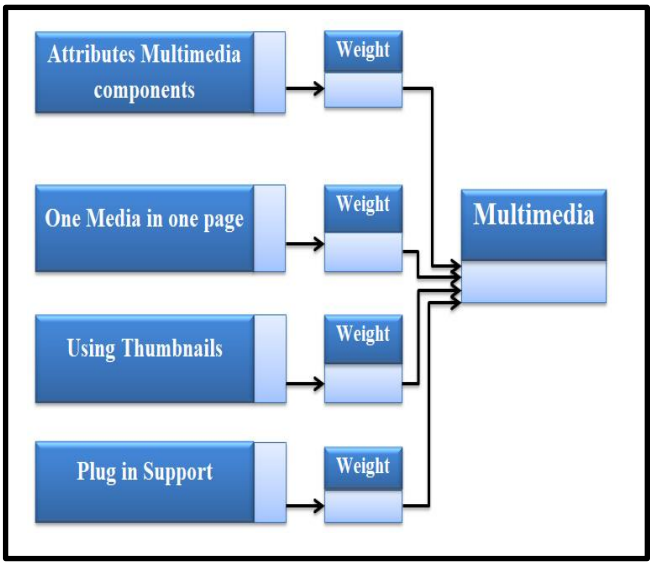


Fig.8. The Indicators Of Multimedia

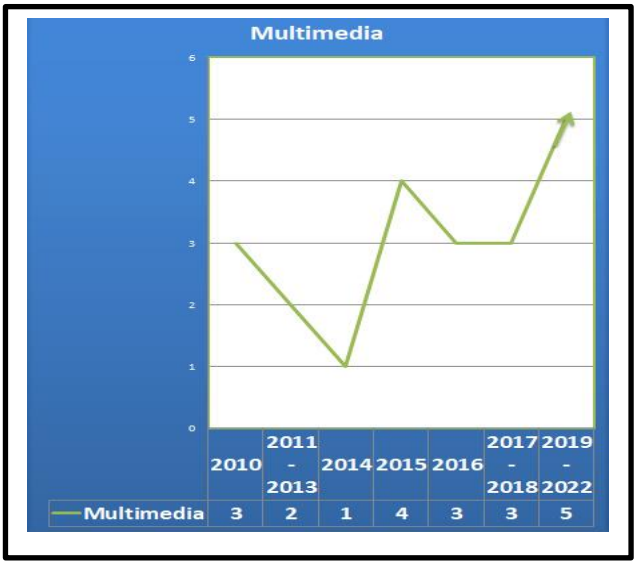


Fig.9. Technological Advances OF Multimedia Criterion

Technium Vol. 8, pp.84-99 (2023)
ISSN: 2668-778X
www.techniumscience.com

The sub-properties of multimedia criterion are :

3.3.3.1. Attributes of Multimedia Components

Flash, music, and video are becoming more and more commonplace on websites. However, there are a number of difficulties when presenting dynamic multimedia, particularly for individuals who misinterpret the multimedia element that does not have a thorough description, despite the fact that they are frequently used in entertainment, newscasts, distance learning resources, etc. As a result, each multimedia component needs to have a clear description, which includes this description (title, variant, summary) ,(Gibbs , 1995) .

3.3.3.2. One Media in One Page

Non-professional websites frequently have more animation elements, which can clog pages and confuse visitors. It is therefore advisable for each web page to contain just one multimedia element (Gibbs , 1995) .

3.3.3.3. Using thumbnails

The thumbnail is known as a preview for a particular image on a Web page, usually includes a hyperlink for a full size version of the multimedia module, multiple multimedia can be used only for each page, so any other media must be represented by a number of thumbnails, so users can view the other multimedia components by clicking the thumbnail button. At the same time, the use of thumbnails can lead to speed up the download time page, so the thumbnail must be selected well with the features (address, alternative) and equivalent size with the determination (display, height), (Gibbs , 1995) .

3.3.3.4. Plug-in Support

An application that interacts with a web browser to increase the functionality of that browser is known as an add-on, plug-in, or add-on. There are numerous presentation formats (including Flash, QuickTime, Microsoft Silverlight, and others) that all work with web browsers through plug-in support (Cha. et al.,2009).

3.3.4. Dependability Metrics

Websites must have reliability in order to be secure and trustworthy. The essential characteristic of a person or organization is reliability, as a result of which the web reliability feature was implemented in the previous research. This is done either directly through a suggestion from a link to another website or indirectly through third party endorsements of rating services displayed on the websites. The strategic value of all organizations is protected by the personal/important assets of the company known as reliability (Fombrun et al.,2009).Reliability is critical when evaluating a website, especially a commercial one, as people are drawn to businesses that have a good reputation (purchasing, registering, downloading, etc.). Additionally, when people discuss the value of a website, they are referring to a broad concept that includes a variety of elements, such as security, usability, efficiency, and search engine ranking (Tan et al.,2009). Fig.(10) shows the characteristics of reliability, and Fig. (11) shows the rate of application of this criterion .

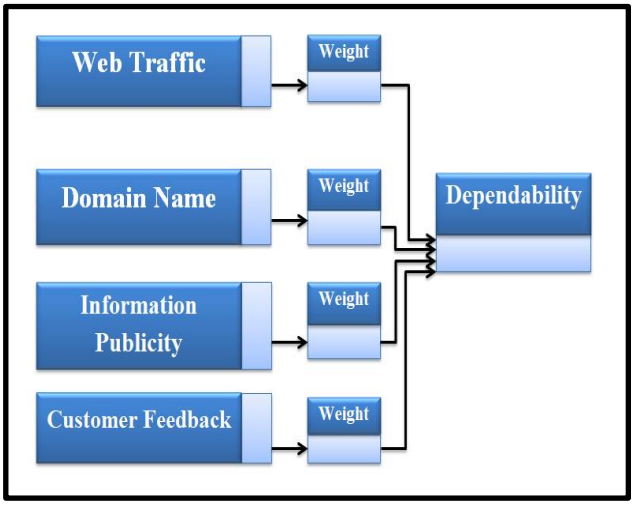


Fig.10. The Indicators Of Dependably

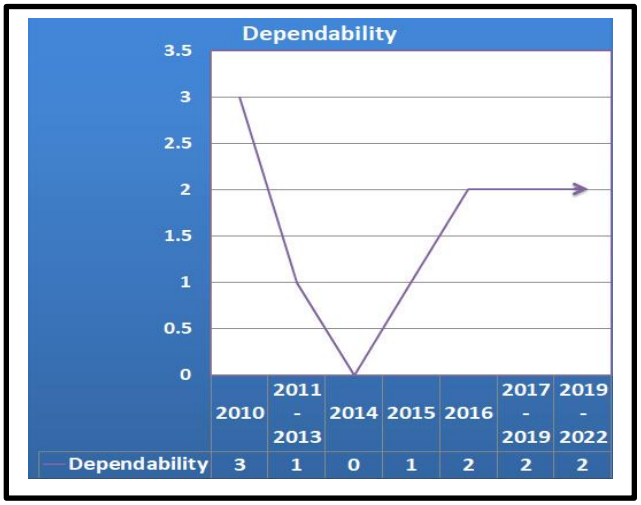


Fig.11. Technological Advances OF Dependably Criterion

Technium Vol. 8, pp.84-99 (2023)
ISSN: 2668-778X
www.techniumscience.com

The sub-properties of dependability criterion are :

3.3.4.1. Web Traffic

Web traffic is an important indicator of both good and bad reputation ,Web traffic is the volume of information accessed by website users, as it reflects the number of pages and users accessing them. Web traffic is an important indicator of a website's popularity and its ability to attract repeat visitors who will make purchases. There are thousands of websites that offer services, strategies or tools to drive traffic, and some of them have years of experience working with multiple clients. In addition, website traffic is critical to rating services (Hernández et al.,2003) .

3.3.4.2. Domain Name

According to Chambers and Barry (Barry et al.,1998), the website of academic or research institutions (.edu or.gov) in a (URL) are more trustworthy than the websites of businesses (.com or.net) in a (URL) that begins with "https://." and ends with ".gov," ".edu," or ".uk" dependable (Barnes et al.,2006) .

3.3.4.3. Information Publicity

As it is represented by a mix of information or links on the websites, advertising information comprises contact information, a privacy statement, and an update date. Small website owners may not always be excited to provide their contact information online because visitors can learn more about them. The choice of whether or not to disclose contact information ultimately comes down to whether the website owners want to be contacted (De Jong et al.,2009) .

3.3.4.4. Customer Feedback

Customer feedback describes a user's involvement in all reputation-building activities (such as premium features, paid features, product quality checks, etc.). It is a general phrase that denotes face-to-face interactions with users or information regarding results, and it encompasses a wide range of activities or strategies while concentrating on (the continuous chain of informatics, from consultation to participatory) , (Kujala , 2003) .

3.3.5. Performance Metrics

The performance measure is the most important metric and many researches depends on it because of its importance significance, as it got the highest usage rate among the previous studies (70.588) as presented in Table (3). website performance refers to the speed of a website and describes how long it takes a website to fully load before appearing on a user's screen . Speed is very important for any website because it has become an important factor over time. Researchers are particularly interested in aspects of website performance, which has been divided into quantifiable indicators in order to measure it (download speed, response time, and visual stability),(Matias,2020) as shown in Fig.(12) which presented that each performance metric indicator has a unique weight based on its importance, while Fig. (13) shows the development of using this metric in the researches .

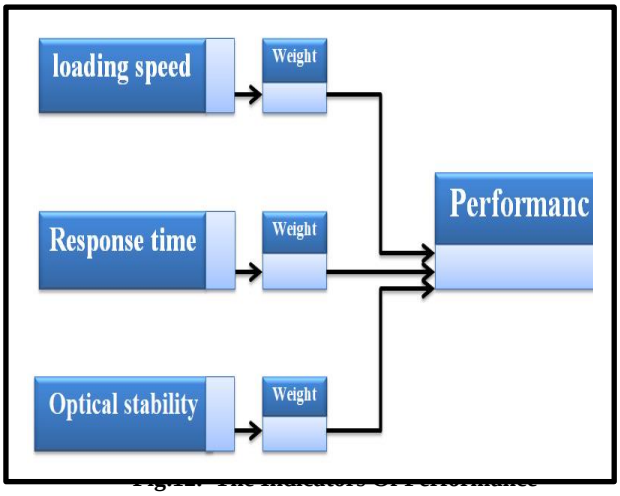


Fig.13. Technological Advances OF Performance Criterion

Technium Vol. 8, pp.84-99 (2023)
ISSN: 2668-778X
www.techniumscience.com

The sub-properties of performance criterion are :

3.3.5.1. Download speed

Loading speed means page loading speed , Moreover, the fast-loading websites generate higher revenue. and websites that take a maximum of (5 seconds) to load generate twice as much revenue a website that takes (19 seconds) to load. A study by the Aberdeen Group also found that a one-second delay in loading time page leads to (11%) decrease in page views, (7%) decrease in Conversion rate, and customer satisfaction decreased by(16%) .The results indicate that the loading time page directly affects (Matias,2020) .

3.3.5.2. Response time

It is the time it takes the system or the functional unit to interact with certain inputs. In computing, the response time is the total time to respond to the service request. This service can be anything from bringing memory, a component database query, or load a complete Web page . Also, one of the most important factors affecting how quickly a website loads is the time spent on Domain Name System (DNS) searches. DNS lookup is the process of finding an IP address associated with a URL. One way to speed up the website is to reduce the number of different hostnames. Fewer DNS queries will reduce response time and cause websites to load quickly. Also, the time it takes to query DNS records depends on the speed of the DNS provider (Matias,2020).

3.3.5.3. Optical stability

Optical stability can be assessed using cumulative planning displacement (CLS), which is defined as a user-focused metric for measuring visual stability. Additionally, pages should maintain a CLS value of less than 0.1 to offer a positive user experience. In order to ensure that a page is pleasurable, CLS helps in identifying how frequently users face unexpected layout changes. When something on a website suddenly changes without warning, the text moves and loses its place, which is an example of visual stability. Or as you're ready to click a link or button, the link moves as soon as your finger moves, causing you to click something else. Although these kinds of encounters are typically frustrating, they occasionally have the potential to be dangerous .

3.3.6 Efficiency Metrics

The efficiency criterion of the website was found to be somewhat acceptable and obtained an estimated usage rate as (35.294 percent) of the previous studies as presented in Table (3), Efficiency refers to a website's capacity for making effective and efficient use of its resources to produce rich information backed by reliable sources. A website's efficiency can be characterized as a collection of many indicators (search engine, bulletin board, information directory, graphics, etc.) and in order to generally meet user expectations; these indicators can be used to enhance the website functionality and access requirements .(Kim,2006) Figure (14) highlights the indicators of the efficiency criterion. The efficiency was selected as essential criterion by certain researchers, but as shown in Fig.(15) in this study, this value has declined in recent years.

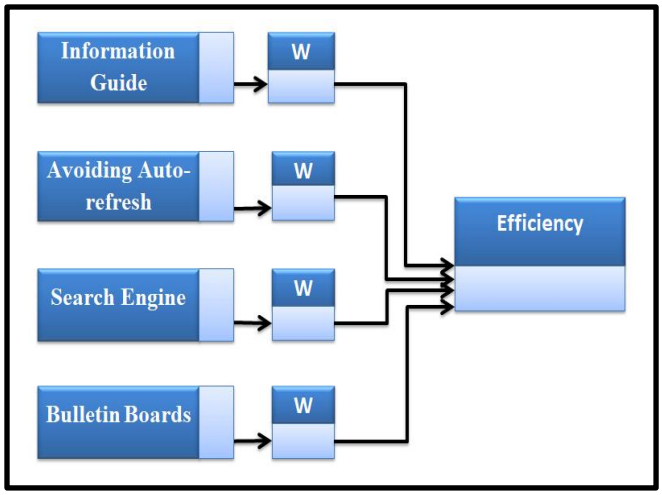


Fig.14. The Indicators Of Efficiency

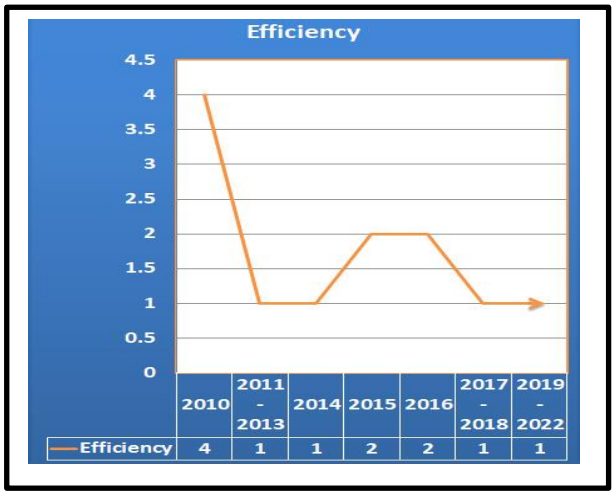


Fig.15. Technological Advances OF Efficiency Criterion

Technium Vol. 8, pp.84-99 (2023)
ISSN: 2668-778X
www.techniumscience.com

The sub-properties of efficiency criterion are :

3.3.6.1. Information Guide

The Information Guide support of helping people who want to browse a specific website. It should include all information about the entire website domain and be usable by people with different levels of knowledge. The information directory should also include information about the summary, extendable text, customizable information, guided tour for first-time visitors, and all information about the entire website domain (Kim,2006).

3.3.6.2. Avoiding Auto-refresh

Users find auto updating to be particularly helpful when they need information immediately, A web technique called auto refresh instructs a web browser to automatically refresh the current web page or a specific frame after a fixed time. However, automatic refresh has pros and cons and is not recommended because it can confuse some website visitors , reduce visual stability, and negatively impact website performance when the page is automatically refreshed(Kim , 2006) .

3.3.6.3. Search Engine

A tool for searching the World Wide Web for information is a web search engine. People are familiar to use search engines these days to look up specific information. When consumers use a search engine on a website, they typically seek highly precise information from that site and do not need the external information (Kim,2006)

3.3.6.4. Bulletin Boards

Many web applications can be supported by the bulletin board. The most efficient way to foster online interaction between user interests and local events is through the bulletin board, which has become a regular component on most live websites. The most popular applications for it are discussion and research forums, but it is also successfully utilized for applications like community and customer service websites, tech support websites, university websites, and even newsletter websites (Kim,2006) .

3.4. Research Question 4: How to evaluate the website quality?

The final evaluation of the website quality can be calculated by using some equations in web quality and performance metrics that proposed by Khan and Liburne (Kim,2006). The website quality evaluation process is determined by giving each criterion the suitable weight in the order of importance, as shown in Fig.(16) .

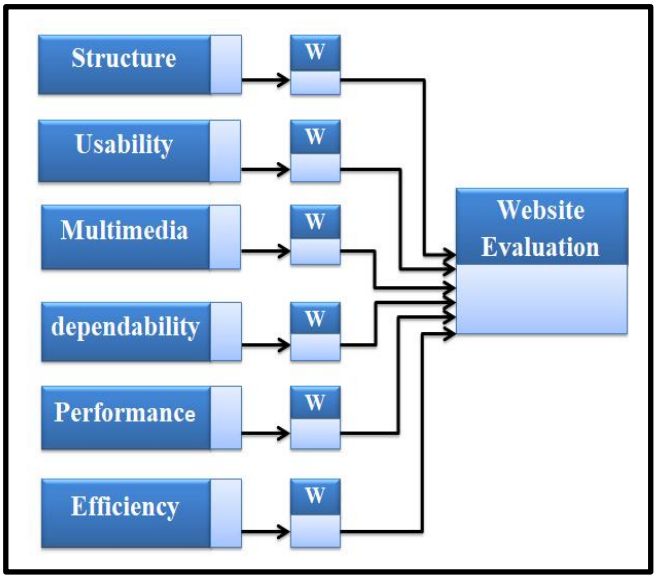
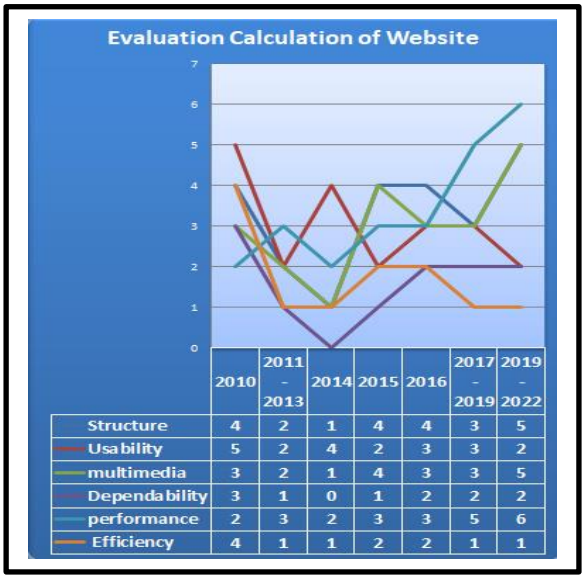


Fig.16. Website Quality Evaluation



	2010	2011 - 2013	2014	2015	2016	2017 - 2019	2019 - 2022
Structure	4	2	1	4	4	3	5
Usability	5	2	4	2	3	3	2
multimedia	3	2	1	4	3	3	5
Dependability	3	1	0	1	2	2	2
performance	2	3	2	3	3	5	6
Efficiency	4	1	1	2	2	1	1

Fig.17. Technological Advances Of All Metrics

According to the significance of each evaluation criterion, the values of the weights in the Figure (16) were selected from Table(3). and the percentages of the evaluation criteria varied depending on how each scale was used by the researchers, while Fig. (17) displays the development of using all of these metrics in the researches .

4. Conclusions

This paper presented a systematic literature review to get an overview of the existing researches in the field of the evaluation the quality of website, Websites are an advertising front for organizations, as a result of which it is necessary to evaluate these sites according to the highest quality standards. Many criteria currently used to evaluate the quality and performance of websites and different papers have been selected between 2010 to 2022 to make a complete study about the evaluation criteria which are: Structure, Ease of Use, Multimedia, Performance, Reliability and Efficiency. A statistical analysis have been presented in this study in term of quality metrics. After a comprehensive study of the previous works, it has been determined that the most researchers focus on the performance, structure, and multimedia in recent years and got high percentages with utilization rate of 70%, 67%, and 61% respectively, that made them useful for design the website .

Funding

This research did not receive any funding.

Conflicts of Interest

The authors declare that we don't have any conflict of interest regarding this study.

REFERENCES

[1] Abdulhadi M. Eidaroos .(2011). Multidimensional Evaluation Approach for an e-Government website . Doctoral dissertation . Department of information science , Loughborough University ; England .

[2] Ahmed Abdel-Karim Diab Al-Sir .(2014). The quality of websites and their impact on the competitive advantage of Palestinian universities in the Gaza Strip . Master's thesis, Deanship of Graduate Studies,College of Commerce, Islamic University, Palestine

[3] Ahmad A M Ghandour . (2010). eCommerce Website Evaluation Framework: An Owner's Perspective . Doctoral dissertation . University of Otago ; Dunedin, New Zealand .

[4] Alisa Dibrova . (2013). Web analytics. Website analysis with Google Analytics and Yandex Metrics . MPhil Thesis ,Malmo University , Sweden.

[5] Ayeh Mahdmina . (2015).Can generic health website quality assessment tools identify the 'best' websites for a specific health topic?: A study of orthognathic treatment websites . Doctoral dissertation . College of Science , University of Liverpool , England .

[6] Bader Methqal AlFawwaz . (2011). Evaluation of eGovernment Websites Usability in Jordan . Doctoral dissertation ; School of Engineering and Design ,Brunel University ; London .

[7] Barry L., and Schamber C.L . (1998) .Users' Criteria for Relevance Evaluation: A Cross-Situational Comparison . *Data management and processing* , PP : 219 - 236 .

[8] Barnes J.S., and Vidgen R. T.(2006) . Data Triangulation and Web Quality Metrics: A Case Study in E-government . *Management and Information Facts* . Amsterdam, Netherlands, PP : 767 – 777 .

[9] Bhargava Bhamidipati.(2022) . Performance evaluation of Web WorkersAPI and OpenMP . Master's Thesis, Faculty of Computer Science University advisor; Karlskrona , Sweden .

[10] Cao X., Liu Y. , Shen B. , and Wang M. (2009). Research on Evaluation of B to C E-commerce Website Based on AHP and Grey Evaluation . *Proceedings of the (2009) International Symposium on E-Commerce Security and Security* , PP: 405-408 .

[11] Cha J. W. , Han Y. , and kim L.(2009) . Evaluation of User Reputation on YouTube . *International Conference on Social Computing (HCI International 2009)*,CA , San Diego, PP:346 – 353 .

[12] Dalal Ibrahem Zahran .(2016). Web Engineering for the Evaluation of Large Complex Web Systems: Methodologies in Web Metrics . Doctoral dissertation . Edinburgh Napier University ; England .

[13] David Mark Swallow . (2017) .Working Practices and Resources for the Creation and Evaluation of Accessible Websites . Doctoral dissertation . Computer Science , University of York ; Britain .

[14] De Jong M. ,Swaak M. and P. De Vries .(2009) . Effects of Information Usefulness,Visual Attractiveness,and Usability on Web Visitors' Trust and Behavioural Intentions .*in Professional Communication Conference (IPCC 2009), IEEE International* ,PP:1 – 5

[15] Divya Ramayampet . (2019).Evaluate Websites Using Data Mining And Opinion Mining . MPhil Thesis . Project at California State College of Art , University Pomona ; California , USA .

[16] Erduan Behrami Vladimir Deric . (2015). Website features' influence on the purchasing decision . Master's thesis .College of Science University of Kristianstad ; Sweden .

[17] Eyad Yahia Makki .(2017) . An Enhanced Quantitative Performance Model for Automatic E-commerce Websites Evaluation . Doctoral dissertation . Electrical Engineering and Computer Science , Catholic University of America ; The capital, Washington , USA .

[18] Firas Mohammed Al-Azza .(2010) . Standards of Quality and Classification of Websites . Quality Assurance Office , Iraqi .

[19] Fombrun C., and Shanley M. (1990). What's in A Name? Reputation Building and Corporate Strategy .Academic Management Journal .

[20] Forsythe, Edward . (2016). Evaluating EFL Learning Websites . Master's Thesis . faculty of humanities , Hirosaki University ; Yorosaki, Aomori Prefecture, Japan .

[21] Gibbs S.(1995) . Multimedia Component Frameworks . *in Object-Oriented Software Composition* , PP : 305-319 .

[22] Hernández-Campos , Jeffay K. , and Smith F. D. (2003) . Tracking the Evolution of Web Traffic: (1995-2003) .Analysis of Communication Systems in the Proceedings of the Eleventh International Symposium on Modeling and Communication .

[23] Hundley, Chase Tyler . (2012). Aesthetic Qualities of Websites and their Effects on Public Perceptions of Agricultural Issues and Organizations . MPhil Thesis . University of Arkansas ; Fayetteville , Arkansas ,USA .

[24] Jeff Sauro .(2016). Measuring the Quality of the Website User Experience . Doctoral dissertation . Information Science Commons , University of Denver ; Denver, Colorado, USA .

[25] Juan Carlos Nieves . (2016).The effect of colour use on the quality of websites . Master's thesis , Cognitive Science , Umea University ; Sweden .

[26] Kim A. J., (2006).*Community Building on the Web: Secret Strategies for Successful Online Communities*, 1st edit, Peachpit Press.

[27] Devkota P., Khan K. M., and Liburne B.(2004) . Measuring Quality Metrics for Web Applications . *RMA International Conference* New Orleans, USA.

[28] Knutson J.F.(1997) . The Effect of the User Interface Design on Adoption of New Technology . Georgia institute of engineering and technology sciences .

[29] Korvald, Christoffer Odegaard .(2014). Automated Usability Testing of Websites Using Link Structure . Master's thesis . Submitted to the Graduate Faculty , University of North Dakota ; USA .

[30] Kujala S.(2003) . User Involvement: A Review of the Benefits and Challenges . *Information Technology* , PP : 1-16 .

[31] Laheeb Muhammad , Manar Younis Muhammad , and Aisha Siddiq Shaheen .(2010) . Ranking sites e-commerce based on the quality assessment model of websites . *Iraqi Journal of Statistical Sciences* , Iraqi ; PP : (273-494) .

[32] Lea, Daniel D.(2019) . Usability Evaluation of a Small Church Website . Master's Thesis . Technical and Professional Communication , University Wisconsin ; Wisconsin, USA .

[33] Liburne B., Devkota P. and Khan K. M. (2004) . Measuring Quality Metrics for Web Applications . in 2004 *IRMA International Conference* ; New Orleans, USA .

[34] Li C., Pu P. (2008). A Cross-cultural User Evaluation of Product Recommender Interfaces . Proceedings of the (ACM) conference held.

[35] Mahmoud, Siham Mukhtar .(2017) . Evaluating and enhancing websites : a case study of an Eritrean state owned media website Information and Knowledge Management , Stellenbosch University , South Africa .
[36] Matias Kinnunen .(2020).Evaluating and Improving Web Performance Using Free-to-Use Tools. Master's Thesis, Faculty of Information Technology and Electrical Engineering / Degree Programmed in Information Processing Science , University of Oulu ; Finland .
[37] Meron Yohannes Woldu. (2014).Evaluating Web Usability from the User's Perspective . MPhil Thesis , Laurea University , Finland.
[38] Miano J. (1999). Compressed Image File Formats: JPEG, PNG, GIF, XBM, BMP: Addison-Wesley . *Systems, Lausanne, Switzerland* , PP : 75-82 .
[39] Mikaela Persson .(2021) . Evaluating the Intuitiveness and User Friendliness of a Public Informational Website . Master's Thesis ,KTH Royal Institute of Technology , Stockholm, Sweden .
[40] Online : Wikipedia **.** Web performance **.** (May 17, 2022) . Accessed : Aug. 06, 2022 : Available from https://en.wikipedia.org/w/index.php?title=Web_performance&oldid=1088308830

[41] Paul Arnold Davis . (2010). Learning Usability Assessment Models For Web Sites . Doctoral dissertation . Office of Graduate Studies of Texas A&M University ; Texas , USA .
[42] Petersen K., Feldt R., Mujtaba S., and Mattsson M. . (June 2008) .Systematic mapping studies in software engineering . *In 12th International Conference on Evaluation and Assessment in Software Engineering (EASE),* University of Bari, Italy, PP 26 - 27.
[43] Quesenbery W. (2001). What Does Usability Mean: Looking Beyond Ease of Use . *Communications Association* , Conference 48 .
[44] Ran Tian . (2015). Examining The Complexity Of Popular Websites . Master's thesis . Computer and Information Science , University of Oregon ; Oregon ,USA .
[45] Robin Granqvist .(2022). The performance of Webflow: a comparative study . Master's Thesis , Faculty of Computing , Blekinge Institute of Technology; Karlskrona, Sweden .
[46] Salla Paajanen . (2014).Usability Of Websites Implemented With Open Source Publishing Platform Word press . Master's thesis . Satakunta University of Applied Sciences ; Finland .
[47] Sarvesh Velore Nagarajan . (2015).Automated Test Input Generation and Test Execution for Websites . Master's thesis ,Faculty of the Graduate School , University of Texas at Austin ; Austin, Texas , USA .
[48] Seppo Hannu .(2016) Web Content Management Software (Usability & Performance) . Master's Thesis .Computer Science, University Of Helsinki ; Finland .
[49] Seyed Hooman Mostafavi . (2018). A Longitudinal Assessment Of Website Complexity . Master's Thesis . Computer and Information Science, University of Oregon ; Eugene City , Oregon , USA .
[50] Shafquat Ali Chishti . (2016).Analysing and Identifying Website Personality by Extending Existing Libraries . Master's thesis . Computing UNITEC Institute of Technology ; New Zealand .
[51] Tan C. , Zhang Y., and Zhao D.(2009) . Evaluating the Enterprise Website Credibility from the Aspect of Online Consumers . *The International Conference on E-Government and E-Commerce* , PP : 14 – 17 .
[52] Tractinsky N. , LA vie T. (1997) . Assessing Dimensions of Perceived Visual Aesthetics of Websites . *International Computer and Human Magazine* , PP : 269 - 298 .
[53] Vladimir Chalupsky . (2011). Evaluation Of Websites Of Universities And Proposal Of An Optimal Solution . Diploma thesis . Faculty Of Business And Management Institute Of Management, Brno University Of Technology , Brno, Czech Republic .
[54] Zihou Zhou . (2010). Websites Quality Evaluating . Master's thesis ,Software Technology Research Laboratory , De Montfort University England .