A Systematic Review of Realistic Methods and Approaches for Evaluation of Website

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Abstract— Internet facility along with a web browser has become indispensable needs to do any government as well as non-government task. To devise and evaluate an unbeaten website, web engineers have to consider the two factors, first is the role of website for achieving company or organizational objectives, afterwards, various types of users with their needs. But both of these factors cannot be fully elicited and defined, as the opinions as well as the ambitions of organizers, website users plus IT professionals are entirely different. In order to find the methods along with approaches used for website evaluation, this paper takes a systematic review of the most popular models which are in sphere of website evaluation in distinct domains of websites. Two types of models are studied, one which can be applied to every domain, whereas other which are oriented towards the specific domain with specific mission. It also analyses the practical methods and approaches to find their percentage usage in previous studies of website evaluation. It also investigates the types of assessors involved in these studies. Finally, it winds up with proposed perspectives what a future evaluation study should be endowed with. It is deduced that recent studies have adopted a user judgement method along with certain automation or numerical computation technique. The findings provided by review can benefit the industry readership as well as academicians to evaluate the website for relevance to their own settings in various situations.

Keywords—Web engineering, Web assessment, Web domains, Website evaluation, Design quality

I. INTRODUCTION

Web engineering goal is to devise an ideal website, as site plea positively reconcile the product plea to increase the consumer's interest towards purchasing [65]. But, the story does not end at here as evaluation of the designed site is very tricky plus cumbersome task. One needs flexible plus adaptable methods along with tools to evaluate the website quality in a systematic and efficacious way for full success. The main technical problems arise due to poor navigation, missing information or contents, problems in operating transaction forms with unsatisfied graphical design [67]. Other problems are due to the dynamicity in different domains of the web such as government, health and education sectors, new business models, along with the disparity of ages among users [28]. However, the location based constraints, i.e. positioning, cost and integration can be overcome by using proper user-oriented model during design of web based application [15, 64]. Furthermore, website contents can be filtered to improve usability [40, 62, 97]. One can also access weblogs to evaluate the metrics responsible for user behaviour to analyze the usability [43]. Some researchers emphasized on using SEO techniques for website popularity during website design [44-45].

To realize any method of assessment, a strategic methodology of the whole process is needed, which is comprised in the form of an evaluation model. A variety of models have been devised in literature for website evaluation. Certain models are multi dimensional [14, 26, 66, 73] whereas others are meant for specific domains [30, 68, 102]. A number of models have been depicted according to ISO guidelines, but they are very general to implement. Certain models have elucidated step by step procedure for evaluation of website [13].

Olsina and Rossi [72] have devised *Webcam* tool to implement the model, but a lot of expertise with enormous time is needed to realize the evaluation of the site. Mich *et al.* [66] have proposed 2QCV3Q model from 7 loci point of view. Various online tools have been used for the illustration of the model. Zhu [104] has evaluated the site by taking three quality dimensions (web source quality, web information quality, with web application-specific quality) by measuring thirteen technical aspects. Mavromoustakos and Andreou [63] have measured five quality factors using forty seven parameters whereas Yen *et al.* [99] evaluate content with design only. To compute the usability of the site, eighty three

parameters which are grouped into ten aspects are proposed by Torrente *et al.* [93]. Malhotra and Sharma [60] have taken structural aspects only to presume a website as good or bad. Mich [65] has defined quality from five points of view and further proposed to reduce the quality gaps between them to improve the site. The foremost fact is that none of these models have been acclaimed as a standard universal model. Most evaluation models have their orientation towards user satisfaction so their main approach is headed for external users only. But some intention should also be given to evaluate the website from an organizational point of view in its development phase as it is the ultimate reason for initiation and enhancement of the website. The concluding website should be evaluated from user point of view, but a well defined strategy for its assessment should also be adopted by taken into account its major ambition. So far, no study strives for in-depth review of website evaluation methods and approaches. To overcome these research gaps in the discipline of website evaluation, this paper intends to identify the chief models expressed in literature for analysis of methods along with approaches.

Classification of website domains is presented in background study so that evaluation studies can be categorized. The research methodology employed in this paper is presented in the next section. The analyses of studies are talked about in the succeeding section. Further, the outcomes with discussions regarding analysis of methodologies of evaluation are embodied in the subsequent section and future scope in this research area is proposed in the last section.

II. RELATED WORK

Internet has been enriched with various web application and web services for a lot of purposes by various organizations. An enormous discussion related to classification of website domains has been existed in literature for design plus evaluation purposes. Zviran *et al.* [105] has grouped the websites on the basis of traffic volume into five types viz- informational, shopping, customer self service, trading with business to business whereas Lee and Koubek [55] has classified sites according to the usability aspect into four categories as entertainment, informational, communications plus commerce.

Deshpande *et al.* [29], Coutin (2002), Perallos [77] and Torrente *et al.* [93] have classified the websites on the functionality basis into eight, ten, eight and sixteen domains respectively. Mich and Franch [68] have divided the sites into ten types on tourism basis. Srivastava and Chawla [88] have organized the sites from content, service as well as technology point of views separately, whereas Ellahi and Bokhari [32] plus Cebi [17] have categorized the sites by taken into account commercial aims. Recognizing the functionality with services offered by website to users as

obligatory factors, this study has dispersed the websites into ten domains as depicted in Table 1.

Table 1 Proposed Website Domains

Domain	Purpose of Website	Examples
Academic sites	To provide information regarding academic institutions and libraries	www.gndu.ac.in, www.ptu.ac.in https://lecturenotes.in
Hotel sites	To provoke customers for previous booking	https://in.hotels.com https://www.tripadvisor.com www.trivago.com/Uttarakhand-Hotels
E-Commerce sites	To facilitate customers for online shopping	https://www.snapdeal.com www.jabong.com https://www.flipkart.com
Airline Reservation sites	To provide airline reservation online throughout the world	www.kayak.com/Airline/Deals www.aerocloud.biz https://www.yatra.com
E-Banking sites	To facilitate the bank customers for online services	https://www.onlinesbi.com/retail/login.htm https://www.jkbankonline.com
E-Government sites	To provide the online services to public from various government sectors	https://india.gov.in/e-governance https://incometaxindiaefiling.gov.in
Tourism sites	To provide the updated information to tourists and enhance business in tourism	https://www.tripadvisor.com www.trivago.com
Social sites	To enhance the socialization among public, academicians, relatives and friends	https://www.facebook.com https://twitter.com https://www.youtube.com
Search Engine sites	To seek out the information regarding any topic from web databases	www.google.com www.yahoo.com
Medical sites	To aware the public regarding hospital facilities, preventive measures to be taken for some disease and even physical exercises.	https://www.medidart.com www.medindia.net www.bestwebsiteinindia.com/categories/health-care-websites.htm

Two classes of website evaluation models have been proposed in this paper. One of them is generic models that have been designed according to the software engineering, principles and do evaluation with a limited number of steps. To evaluate the website one needs, requirement gathering from various types of unknown user which is a very unwieldy task [27]. Generic models are mainly milestones of web evaluation. These models provide a lot of flexibility for experienced evaluators whereas new website engineers face a problem of decision making for their application [66, 72, 99].

The other category of models deals with domain models which are very easy to implement, but the way they have portrayed assumptions, instructions, metrics, with tools and techniques [93-94] make them domain and task specific Domain models are basically applications of generic models [72]. When generic models are applied in a specific domain their features are reorganized according to the objectives of evaluation [65-66]. Some evaluation metrics are not needed or preferred for any specific domain site whereas for another type of site same metric can be more significant, e.g. high quality images for a shopping site can be the most prioritized requirement as the final product should have high class visibility than some other banking or educational site. For academic site evaluation, the model proposed by Afonso *et al.* [2] measures the web log data, i.e. number of unique visitors, total visitors, hits, and bytes accessed to predict the usability of high school of education. Some studies have mission for evaluating e-learning [16, 41] while others evaluate just one or two parameters of the site, i.e. service quality [92] and usability [37]. Joo *et al.* [48] have evaluated the efficiency, effectiveness and learnability of academic library websites. For assessment of hotel websites, Alhelalat *et al.* [3] have demonstrated the interrelationships among the main conceptual parts, including the specific hotel website features for determination of website benefits from user, organization as well as stakeholder point of view. Pranić *et al.* [81] has evaluated websites for performance by filling a questionnaire from 30 trained persons who have examined the site deeply. A recent study has been performed in Poland to compare the banking websites using multilateral analysis [23]. Chiemeke *et al.* [19] have analyzed the parameters with relationship diagrams. Some researchers [9, 79] have focused on a particular sub - domain like e-taxing and audit official sites in e-government domain. Grimsley and Meehan [36] have measured the public value of site whereas Alomari *et al.* [4] have determined the critical factors for adoption of e-government websites. The methodologies used for evaluation of academic and airline websites have been highly dependent on heuristic evaluation using a survey with questionnaires [2, 30-31, 48, 85, 91]. Suwawi et al. [91] have used the Kano's model to compute Q-Score. Content analysis along with hierarchical cluster analysis has been used to assess hotel websites [7, 101]. Yoo and Donthu [100] have devised a scale (SITEQUAL) to determine the perceived quality of a shopping website using factor analysis. Major studies in E-commerce site evaluation have proposed numerical computation techniques like confirmatory factor analysis [76], Chi- square testing [33], and regression analysis [76, 84]. Garcia *et al.* [34] have proposed g-Quality method for evaluation of design of e-government websites. The main evaluation techniques used for evaluating e-government websites have highly dependent on user judgement [36, 38, 75, 87] whereas Jati and Dominic [47] have used web diagnostic tools to measure the performance quality of 5 Asian countries. Lu *et al.* [59] have proposed an index system for website evaluation using an analytical hierarchy process along with fuzzy synthetic evaluation. Social sites have been evaluated to study the sociability features and their relationships [24, 35, 50, 86]. Korda and Itani [53] have worked for determination of types and effects of social media used for health promotion. Chinthakayala *et al.* [20] have compared Facebook, Twitter and Myspace for usability as well as sociability. Search engine sites have been analysed for comparion by Vaughan [95] as well as Jansen and Spink [46]. Moreno *et al.* [69] have proposed qualitative methodology for evaluating the quality of medical sites using 2-tuple fuzzy linguistic approach.

To determine the trends in evaluation studies of websites, this study has adopted systematic literature review (SLR) approach which has been defined by Kitchenham [52]. After demarcating the research problem, the research questions have been defined. Then research process has been conducted to retrieve the studies from online databases. The publication selection process has been implemented through quality assessment method to select the quality studies. After that, data have been extracted from studies to perform analysis of evaluation methods as well as approaches.

III. METHODOLOGY

For determination of evaluation studies, SLR approach has been embraced as it provides a systematic mode of mining the data from the literature and conveying the results [52]. SLR has been dispersed into three main segments which comprised of designing, implementing and concluding the review. For designing and implementing the review, various systematic tasks have been performed which have been presented in this section.

Research Problem: There exists so much disparity in the evaluation studies of websites. These studies have adopted different methods and techniques for evaluation. Certain works have also determined the relationship between the evaluation aspects [80] whereas a few are oriented towards formalizing the existing models [103]. A small number of researchers have given the intention to classify the methods used in these studies [54]. The main contribution of this review is to provide insight for website evaluation approaches in different website domains so that future evaluation studies can be enhanced easily in the particular website domain. It also provides challenges for practitioners working on generic models in website evaluation. It concludes with the most frequently used website evaluation approaches and uncovers research gaps for future work.

Research Questions: In order to find the most appropriate methods which are in trends currently in the field of website assessment and to identify the research challenges in the same discipline, the major research questions addressed in this study are:

RQ1: To determine the different methods and approaches used in generic as well as domain oriented website evaluation models from the last fifteen years.

RQ2: To analyze the usage of website evaluation methods along with approaches and to uncover the research challenges in this discipline.

Table 2 Quality Assessment Criteria for Articles

Q.	Description
1.	Are the aims of the study clearly explained?
2.	Is the scope of study distinctly defined and for evaluation of the websites?
3.	Is the adopted research methodology satisfied the aims of the research?
4.	Is the data collected and analyzed sufficiently to provide conclusions?
5.	Are the findings of the research are clearly stated?
6.	Is the study having value of research?

Research Process: In the very first step, the major databases like IEEE, Springer Link (SL), ACM Digital Library (ACM), Wiley Online Library (WOL), Emerald (EM) and Taylor and Francis (TF) have been assessed to attain the research papers on website evaluation. Some reputed papers have been also collected from Science Direct (SD) (http://www.sciencedirect.com) and Google Scholar (GS) (http://scholar.google.com) by searching the keywords 'Frameworks for website *evaluation*', '*Models for website evaluation*', '*Website measurement', 'Website assessment*' and so forth. Similarly, frameworks for various domains by entering the keyword of specific domain along with previously discussed keywords have been searched and collected for example, in academic studies key words can be '*Frameworks for academic website evaluation*', '*Models for academic website evaluation*', '*Academic w*ebsite measurement', 'Academic website assessment*'.

Publications Selection Process: The procedure used for selection of quality and relevant research studies comprises of four stages, has been presented in Figure 1. About one hundred and fifty papers have been acquired from previous fifteen years. These articles are conferences, journals as well as workshops articles. Then, their abstracts with introduction have been interpreted to seek out their relevance to the topic. One hundred and twelve articles are selected after eliminating the irrelevant and duplicated articles. The next step involves the selection of articles based on study of introduction and conclusion. Ninety five pertinent papers have been opted for detailed study after this step. Then, full text of articles has been analysed through iterative group discussions. Seventy five articles have been finalized for in depth literature review after assessing the quality criteria as mentioned in Table 2. At the end, it has been deduced that the evaluation studies can be categorized as generic models and domain models. Thirteen generic models have been found along with several other works in different domains.

Table 3 Generic Models

Author /Authors	Methodologies Used	Source
Olsina and Rossi [72]	i. WebQEM tool ii. Linear additive scoring method iii. Templates to extract information regarding measurable indicators	IEEE
Mich *et al.*, [66]	i. Various online tools, e.g. http://www.usableweb.com, http://www.htmlhelp.com/tools ii. Questionnaires and interviews of domain experts	IEEE
Zhu [104]	iii. Web mining iv. OLAP	GS
Mavromoustakos and Andreou [63]	i. Questionnaires from experts as well as end users ii. Statistical analysis via frequency and median	GS
Yen *et al.* [99]	i. Requirement Analysis ii. Mapping between layers is illustrated via a case study	SD
Chiou *et al.* [21]	i. Comparative analysis techniques.	SD
Alsmadi *et al.* [5]	i. Web crawler ii. HTML parser	IEEE
Kincl *et al.* [51]	i. Hypothesis evaluation by experimentation ii. Statistical techniques	TF
Rocha [82]	i. Questionnaire	EM
Torrente *et al.* [93]	i. Heuristic evaluation by expert judgement	SD
Malhotra and Sharma [60]	i. MATLAB ii. A Web Metrics Analyzer tool (developed in JAVA) iii. Statistical measurements	IEEE
Cebi [18]	i. Fuzzy DEMATEL theory ii. Choquet integral	SD
Mich [65]	i. Delphi ii. Inspections iii. Comparative evaluation iv. Experiment tests v. Questionnaires, interviews	IEEE

Data Extraction: Each generic study has been analyzed for obtaining methodologies used for evaluation of the website in order to answer RQ1. The outcomes of extraction along with source of study are depicted in Table 3. Each domain specific study has been also deeply examined to identify methodologies used for evaluation as well as the source of each study has been extracted and listed.

Table 4 Domain Models

Website domain	Studies References	Methodologies used	Source corresponding to citation
Academic	[2, 48, 83, 91]	• Survey questionnaire • Descriptive statistics and internal consistency test • Factor analysis • Heuristic evaluation	IEEE, GS, ACM, SD
Hotel	[3, 7, 81, 101]	• Content analysis. • Hierarchical cluster analysis • Interviews and questionnaires • Hypothesis analysis	GS, SD, GS, GS
E-commerce	[8, 33, 74, 76, 84, 89, 90, 100]	• Factor analysis • Online questionnaire • Reliability and validity tests • Regression analysis • Hypothesis testing • Chi-square statistical testing • Survey using Fuzzy TOPSIS • Web data mining	GS, GS, SD, GS, SD, SL, SD, GS
Airline Reservation	[30, 31, 85]	• Online survey • Quantitative analysis • Additive Difference Mode • Expectancy Disconfirmation Theory	IEEE, GS, TF
E-Banking	[1, 19, 23, 49, 57, 98]	• Interviews, walkthroughs, inspection and checklists • Sample data analysis • Structure equation modelling • Multilateral analysis • Heuristic evaluation	GS, GS, SL, GS, SL, GS
E-Government	[4, 9, 10, 34, 36, 38, 47, 75, 79, 87, 96]	• Survey data analysis. • Structure equation modelling • Heuristic evaluation using case studies • Graph theory • Web diagnostic tools	EM, GS, SD, SL, SL, GS, IEEE, SD, ACM, IEEE, SD
Tourism	[11, 12, 22, 25, 42, 54, 58-59, 68, 70]	• Survey with questionnaire • Confidence levels evaluation • Analytical Hierarchy Process • Fuzzy Synthetic Evaluation • Heuristic evaluation • Web log data analysis	SD, GS, SD, SL, WOL, SD, SL, GS, GS, TF
Social	[20, 24, 32, 35, 50, 53, 56, 71, 86]	• Exploratory study • Hypothesis evaluation • Structure equation modelling. • Web-based evaluation tool • Survey conduction • Content analysis using Weblogs • Confirmatory analysis and regression techniques.	SL, TF, SD, SL, EM, GS, SD, GS, IEEE
Search Engine	[6, 46, 95]	• Statistical evaluation • Analysis of nine transactional log data sets	GS, SD, SD
Medical	[39, 61, 69, 78]	• STaRNet website assessment Tool (SWAT) • 2-tuple fuzzy linguistic using focus group technique	GS, GS, SL, SD

All these findings have been depicted in Table 4.

Data Synthesis: This step involves bringing together the various aspects retrieved from data extraction so that results can be evaluated and analysed. Table 5 depicts distribution of publications from year wise versus domain wise point of view. The evaluation methods have been broadly categorized into five types as counting, automated, user judgement, numerical computation, and combined methods [54]. Application of these methods in evaluation studies has been depicted in Table 6.
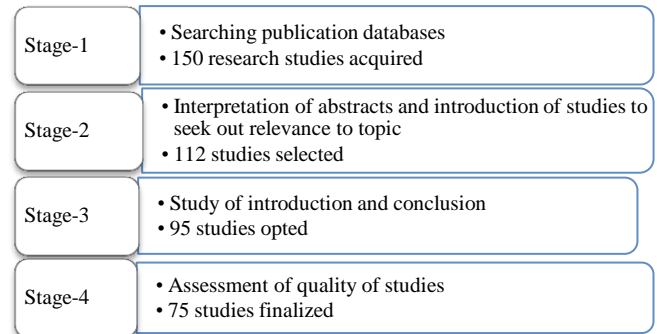

Figure 1 Publication Selection Procedure

Table 5 Year-wise versus Domain-wise Distribution of Studies

Studies/ Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Generic models		1	1	1		1	1			2		2	3	1		
Academic sites											1	1		2		
Hotel sites					2		1							1		
E-Commerce sites	1	1			1		1	1	1			2				
Airline Reservation sites					1								1	1		
E-Banking sites			1		1	1							1			2
E-Government sites				1	1	2	2		2		1	2				
Tourism sites				1	1	1	2	1		1	2			1		
Social sites									1		4	1	2	1		
Search Engine sites				1		1										1
Medical sites		1		1	1					1						
Total	**1**	**3**	**2**	**5**	**6**	**8**	**6**	**3**	**4**	**4**	**8**	**6**	**9**	**5**	**2**	**3**

IV. RESULTS AND DISCUSSION

This section analyses the results for research question RQ2.

Year wise versus domain wise analysis: Table 5 demonstrates that generic models are almost dawned linearly with time. It is due to the development of enhanced models in different domains to overcome the shortcomings of previous models. Maximum website evaluation studies are reported in the domain of e-government, whereas the discipline of e-commerce along with tourism comes in next priority. These are the domains which deal with public maximally by

involving the users of several ages. Tourism and commercial sites have been evaluated for monetary benefits as clients are just one click away from them to shift to another competitive site in case of dissatisfaction.

Table 6 Distribution of Evaluation Methods

Domains/ Methods	Counting	Automated	User Judgement	Numerical Computation	Combined
Generic models	[72, 82]	[5, 104]	[18, 63, 65, 93, 99]	[60]	[21, 51, 66]
Academic sites		[2]	[83, 91]		[48]
Hotel sites			[3, 81, 101]	[7]	
E-Commerce sites		[84]		[76, 89-90]	[8, 33, 74, 100]
Airline Reservation sites			[30, 85]		[31]
E-Banking sites	[1]		[19, 98]	[23, 57]	[49]
E-Government sites		[47]	[9-10, 34, 38, 87]	[36, 79]	[4, 75, 96]
Tourism sites	[42, 68, 70]		[11-12, 22, 58]	[25, 59]	
Social sites		[53]	[20, 34, 50, 71]		[24, 32, 56, 86]
Search Engine sites		[46]		[95]	[6]
Medical sites		[39, 78]		[61, 69]	

Analysis of the methods adopted in website evaluations: It has been illustrated in Table 6 that the majority of the studies have followed the *user judgement method* for evaluation of websites in every domain. However, *combined approaches* have been also preferred which involved *user judgement with some numerical computation technique* [4, 8, 24, 31-33, 48, 51, 56, 74-45, 96, 100], or *counting with user judgement* [21] or *automation with user judgement* [6, 49, 66, 86]. Again, majority of combined methods have employed *user judgement* in combination with others. *Counting* has been the least preferred method as each evaluation study has a different aim and there are no standardized lists of features which are available to prepare a checklist for comparison. Complete picture of methods involved in all studies has been depicted in Figure 2.

Analysis of studies by nature: The evaluation studies can be dispersed into three categories. One category encompasses quantitative studies which measure some quantitative metrics

by extracting data from weblogs with the help of web mining tools [104] or by doing structural analysis on pages of website with the help of some parser or online tools [5, 60]. Another category consists of qualitative studies which evaluates some unique features of website from user point of view or managerial point of view with the help of user judgement methods [48, 76, 98].

Table 7 Distribution of Studies by Nature

Domains/ Nature of study	Quantitative Only	Qualitative Only	Quantitative and Qualitative	Conceptual	Experimental	
					Particular	Comparative
Generic models	[5, 60, 72, 82, 93]	[18, 51, 63, 65, 66, 99]	[21, 104]	[5, 21, 66, 72, 82, 104]	[18, 51, 65, 93, 99]	[60, 63]
Academic sites	[2]	[48, 83, 91]		[83]	[2, 48, 91]	
Hotel sites		[3, 81, 101]	[7]		[3, 7]	[81, 101]
E-Commerce sites	[8, 76, 84, 100]	[33, 74, 89-90]		[89]	[8, 33, 76, 84, 100]	[74, 90]
Airline Reservation sites		[30, 31, 85]			[31, 85]	[30]
E-Banking sites	[19, 23]	[1, 57, 98]	[49]		[1, 49, 57, 98]	[19, 23]
E-Government sites	[9-10, 38, 47, 79]	[4, 34, 36, 87]	[75, 96]	[36, 75, 87, 96]	[4, 9-10, 34, 38]	[47, 79]
Tourism sites	[25, 59]	[11-12, 22, 42, 58, 68, 70]	[54]	[42, 54, 68, 70]	[12, 22, 25, 58-59]	[11]
Social sites	[20, 53]	[24, 32, 34, 50, 56, 71, 86]			[24, 32, 34, 50, 53, 56, 71, 86]	[20]
Search Engine sites	[46, 95]		[6]			[6, 46, 95]
Medical sites	[61]	[39, 69, 78]			[39, 61, 69, 78]	

Third category of studies have opted combination of quantitative and qualitative measures. These studies have dispersed the qualitative features into quantitative measures and then use some weighing methodology to compute some index or score value [6-7, 49, 75]. The distribution of quantitative/qualitative studies in various domains has been presented in Table 7. It can be concluded that qualitative studies are more than quantitative studies.
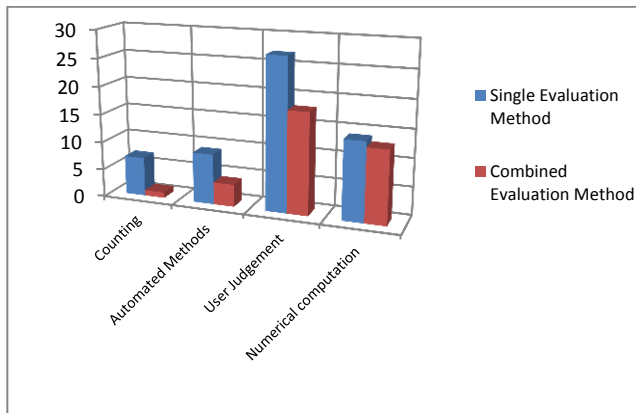

Figure 2 Analysis of Evaluation Methods

An added classification disseminates the studies into two categories. The first category is of a generic nature and it presents a conceptual model. These models are devised due to the appeal of researchers in website evaluation. The conceptual models for website evaluation have been also recommended in particular domains [83, 89]. The second category is due to the nature of the experiment which is further segregated into two groups. One group of studies, evaluates the sites for particular predefined aim, whereas another group assesses the sites on the same domain for comparison purposes. The distribution of these studies has been signified in Table 7.

It can be deduced that most studies are conducted to achieve some particular goal. Maximum generic studies have embraced conceptual models as they can be applied in any domain. Some conceptual studies have been also noted in the field of e-government sites. The analysis of the studies by nature has been depicted in Figure 3a and Figure 3b.

Analysis of Studies by Assessor: Another decisive factor classifies the studies according to the type of assessor involved in evaluation of the website. Three types of assessors have been observed in the examined studies. The middle of the road has been covered by users as they are the end persons who ultimately perceive the quality of sites. So, most of the time, website designers have evaluated the sites from user point of view. Certain studies which involve conceptual and/or mathematical models are researcher based. Very few studies have taken managers of organizations as evaluators of the site. Organizers are successful only when

their clients i.e. users of the website are satisfied so ultimately the users have been taken as the first priority as assessors. The distribution of studies according to assessors versus domain has been represented in Table 8 whereas the analysis of studies from assessors' point of view has been illustrated in Figure 4.
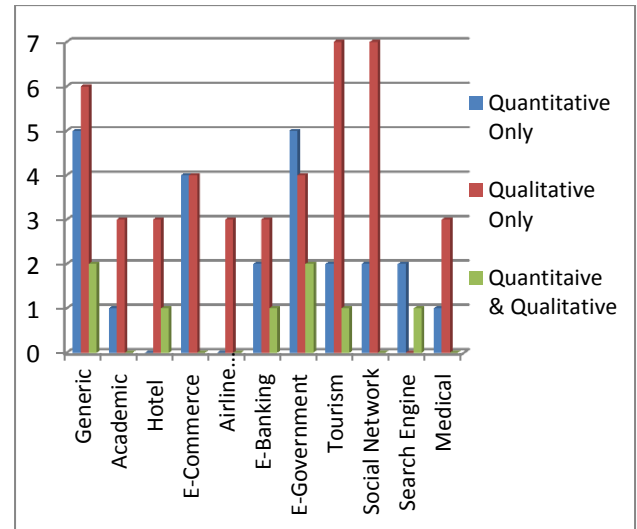

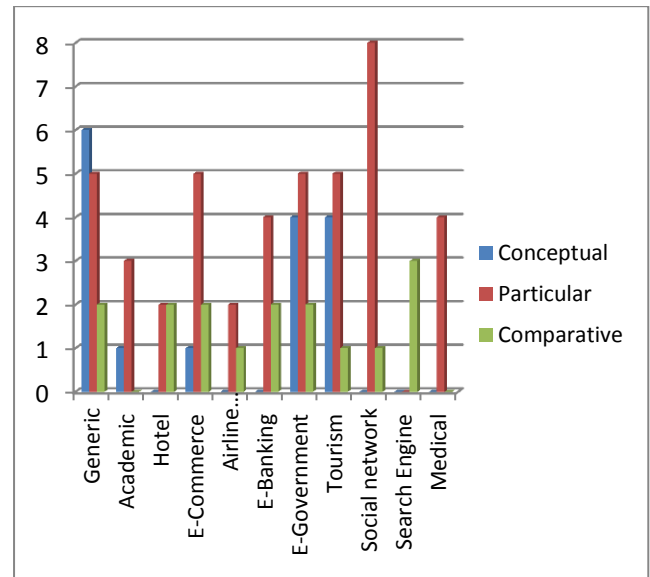Figure 3a Analysis of studies by nature point of view-1

Figure 3b Analysis of studies by nature point of view-2

It should include important findings discussed briefly. Wherever necessary, elaborate on the tables and Figureures without repeating their contents. Interpret the findings in view of the results obtained in this and in past studies on this topic. State the conclusions in a few sentences at the end of the paper. However, valid colored photographs can also be published.

As this research is premised to have an insight for the different methods and approaches adopted in website evaluation so the various identified realistic approaches for website evaluation studies have been depicted in Figure 5. SLR protocol has been followed to achieve the research purpose and seventy five papers are deeply examined. Thirteen generic models along with eleven, ten, eight and nine studies from e-government, tourism, e-commerce and social networking disciplines respectively have been extensively investigated to attain sound conclusions.
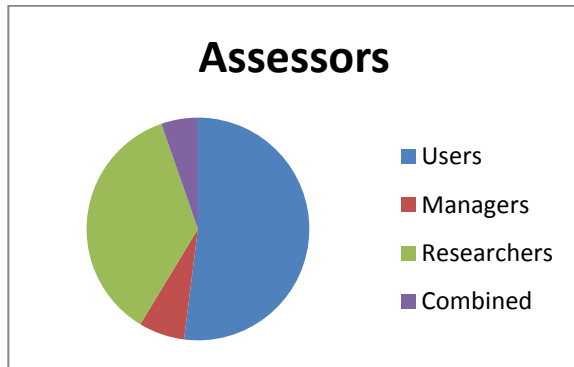

Figure 4 Analysis of studies from assessors' point of view

Table 8 Distribution of Studies by Assessor

Domains /Assessor	User Oriented	Managerial Oriented	Researcher Oriented	Combined
Generic models	[18, 21, 51, 63, 72, 82, 93]		[5, 60, 99, 104]	[65-66]
Academic sites	[2, 48, 83, 91]			
Hotel sites			[7]	[3, 81, 101]
E-Commerce sites	[8, 33, 76, 100]	[84, 90]	[74, 89]	
Airline Reservation sites	[30, 31, 85]			
E-Banking sites	[1, 19, 23, 98]		[49, 57]	
E-Government sites	[4, 9-10, 34, 96]	[38]	[36, 47, 75, 79, 87]	
Tourism sites	[11-12, 22, 58]		[25, 42, 54, 59, 68, 70]	
Social sites	[20, 24, 50, 53]		[32, 34, 56, 71, 86]	
Search Engine sites	[6, 46]	[95]		
Medical sites	[61]	[78]	[39, 69]	

Methods used in evaluation: The main method used for website evaluation is the user judgement method. Out of

seventy five studies, it has been used in forty five studies in which twenty seven studies have used it in isolation. So, 60% studies embraced this method in spite of its biased nature. Website studies in commerce, search engine and medical domains have not used this method alone; rather it has been utilized in combination with other methods.

The next esteemed method is numerical computation techniques which have been used in 36% of total studies from which 18.7% studies have used it unaccompanied with other methods. Among the studies which used combined methods, 72% studies have used the combination of user judgement along with numerical computation techniques. Due to the new technique, automation has been exercised in 17% studies, whereas only 10.6% studies have employed the counting method as this method is becoming obsolete in current studies.

The approaches used in evaluation: The chief accepted approach is the qualitative study. It can also be deduced from methods used for evaluation, as the results presented by user judgement method are in qualitative grades. 68% studies have done the evaluation of qualitative criteria, and 57.3% among them have solely used qualitative approach whereas 10.7% studies have embraced both approaches. 32% assessments have demonstrated the quantitative results only. All studies related to domain of search engines have computed quantitative measures, whereas in e-commerce, domain ratio of quantitative versus qualitative studies is 1:1. All airline-reservation site evaluations have used only qualitative approaches. The next classification for evaluation approaches is segregated the studies into conceptual versus experimental nature. Only 21.3% studies have been represented conceptual models. Among them, 46% generic models have been devised on conceptual approach, whereas 54% research has demonstrated the models with case studies. From 78.6% experimental research papers, 57% papers have assessed the sites for some specific objective, whereas 21% studies have worked for comparison of websites in the same domain. All research studies which have been reported in the domains of hotel, airline reservation, e-banking, social network, search engine and medical sites are of an experimental nature. All search engine websites have been evaluated for comparison purposes. Medical sites are evaluated for information objectives only.

Assessors involved in evaluation studies: All research papers have been analyzed to determine the evaluator who assesses the sites. In generic studies, 61.5% evaluations have been assessed by users, whereas 30.7% studies solely scrutinized by researchers. All academic and airline reservation sites have been measured by users, whereas 25% hotel sites are evaluated by researchers. 50% of e-commerce studies have been done with the involvement of users where as rest 50% studies have been equally worked on by managers and

researchers. 7.7% generic studies and 75% hotel site evaluations used combined evaluators. For e-banking evaluations, the ratio of users versus researchers working as evaluators is 2:1 whereas for e-government domain, it is 1:1. 50% of medical sites have been measured by researchers, 25% by users and 25% by managers. So, from total evaluations 52% are user based, 6.7% are managers oriented, and 36% are researcher centred. 5.33% studies have been assessed by user and researchers together.

At the end, it can be concluded that the first preferred method for evaluating is a *user judgement* with qualitative and experimental approaches. The *numerical computation* techniques have been utilized in next priority. *Counting* is the least used method and becoming obsolete by now. Most of the sites are scrutinized by users, whereas a few are appraised by researchers.

V.   RESEARCH GAPS

Numerous methods and approaches have been talked about for the purpose of website measurement in this paper. Each approach has its own pros and cons. As counting method needs a checklist for comparisons so, it can compute only requested and expected quality and it hardly measures quality in use and perceived quality. Similarly, automated methods can examine the technical design quality aspects and have limitation to compute the perceived design quality. Even user judgement methods assess the qualitative aspects for user satisfaction purpose and do not evaluate the performance of website in numeric form. These methods are also biased and accuracy level is hard to predict as sites engage a variety of users having different age-groups and needs. The numerical computation technique is far much better as it involves mathematical function to produce numeric scores, but has engrossed complicated process for its implementation.
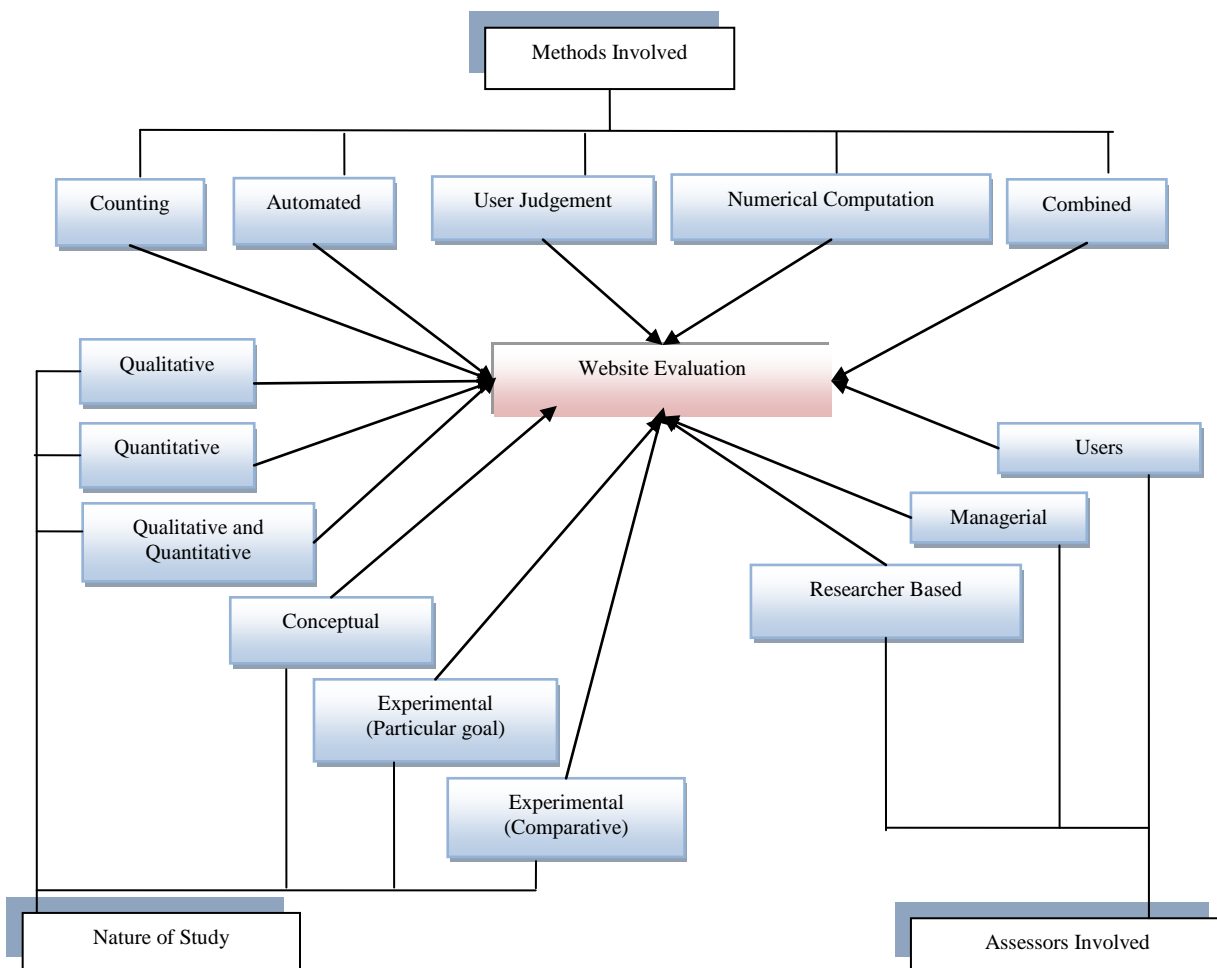

Figure 5 Approaches in Website Evaluation

Combined approaches are best to adopt, but needs new procedures to attain success at sophisticated levels. Another fact that has been observed in previous studies is the avoidance of total quality evaluation as majority of studies is oriented towards user satisfaction. Only a few conceptual models have portrayed the line of Attack for total quality [65-66,72]. Quantitative metrics need sophisticated weighing methodologies to combine them for predicting the qualitative figures. The recent studies adopted the fuzzy techniques to quantify the qualitative measures [6, 18, 93].

Recommendations of study: In future a sophisticated technique which combines automation and numerical computation with theories, algorithms and models from disciplines of human behaviour and psychology are needed, as the supreme importance of ultimate suppliers and users of the website cannot be neglected. Automated models should be validated by the involvement of industry practitioners and consumers of websites. So, ultimately user judgement, technique can't be ignored. New evaluation studies should involve all types of assessors as researchers are required to devise new models, but with the help of organizational needs and various users. Previous models can also be enhanced with the use of new algorithms and methodologies whereas conceptual studies can be experimented in different domains. The future studies should adopt the methods which evaluate total quality and not only some aspects of it. They must be user oriented, but they should not neglect the organizational goals.

Delimitations to validity: There are several limitations to the results finalized in this paper. Most of the literature is collected by first author and there exists a possibility that single researcher can be biased and extract wrong data. He can also miss some relevant research articles. Although, every study which has been used in analysis is deeply examined and finalized by second author also. Second delimitation is that the classification of methods used for analysis can be varied as there can be more new methods in other disciplines like psychology and human behaviour. I order to overcome the first delimitation, two or more reviewers can be appointed for collection of research articles. For second delimitation, authors can examine other disciplines for more classifications of approaches.

VI. CONCLUSION AND FUTURE SCOPE

This paper highlights the practical approaches used in website evaluation. A lot of models have been approached and discussed. Generic models are devised according to software engineering principles, but another class of models which are domain oriented deals with some specific disciplines of websites. Evaluation studies of different domains have their own objective and criteria for evaluation. Due to the evolving web, new domains are created very frequently, and one needs new evaluation strategies for them. But the majority among evaluation strategies have been developed upon generic models as base guidelines with minor amendments. So, there is a trade off between development of generic models and domain models. The core fact is that none of these models has been realized as a standard process model for website evaluation. A lot of heterogeneity exists in the literature, even in generic studies and every research has been fully oriented towards its specific mission during the study.

However, major five evaluation methods have been determined after examining the previous studies, but the most used method is user judgement (60%) along with qualitative approach (68%). Two types of approaches have been recognized i.e. concept based and experiment based. As domain oriented studies have been much more than generic studies, so major applied approach was experimental (78.6%) where sites are mainly assessed by users (52% in isolation, 5.33% in combination with researchers or managers). Recent studies have preferred the combination of the methods used for evaluation previously to obtain quantitative as well as qualitative results, but more sophisticated techniques which involve theories, algorithms and models from the domains of psychology, economics and human behaviour are yet to design and implement.

Most of the studies have worked on specific goals with major impact is for user satisfaction, so, there is a need to define the new evaluation methodology which can evaluate the total quality from the user, organizer as well as researchers point of view. In future, combined approach of quantitative and qualitative measures should be adopted with the involvement of some fuzzy techniques. The main impact should be given to the design quality of a site, as poorly designed sites are not easy to operate and can also lose perceived quality with the user interest. Researchers should work on inventing the methodologies which bridge the quality gaps of the website from the technical point of view with user point of view. For enhancement of presented work, researchers can pursue for validity of above web evaluation approaches through empirical studies in industry. Moreover, additional methods and approaches can be identified for present web evaluation approaches.

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