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OVERVIEW OF WEB TECHNOLOGY USED, WEB CONTENT AMOUNT AND WEBSITE POPULARITY IN SELECTED GOVERNMENT MUNICIPAL WEBSITES

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Abstract

A government website is a gateway for the citizens to get trustworthy information and services provided by each department and division. The extent of providing high-quality contents, good design, and other measures need to be examined so that government websites are effective,i.e. to keep the users engaged. The research aims to investigate relating factors that may affect user engagement of municipal government websites. The study supports both the Government Transformation Programme (GTP) and the Digital Transformation Programme (DTP). Simultaneously, it is hoped that it will also be the exact and an immediate channel in improving the socio-economic growth of Malaysians aligning with National Key Results Areas (KNRA) of improving urban and rural development. As part of the preliminary study, the data collection methods applied were literature review and self-evaluative investigation on ten (10)government municipal websites within the Klang Valley, Malaysia. It can be concluded that the connections in between the factors can be considered in developing an effective government website model focusing on better user involvement and participation. The study will also benefit the web content management practitioners and web developers in identifying which website objects or content features in websites had been used effectively. In future, the study can be leveraged and extended by including an evaluation of a larger number of websites and the use of referential analysis.

Keywords: Web technology; Website content amount; Website popularity; Government websites; User engagement;

1.0 INTRODUCTION

The Malaysian government had targeted 90% of government services to be online through the Government Transformation Programme (GTP) in 2013. However, under achievement of the target was reported. Issues such as low popularity ranking and less user engagement continue to plague the Malaysian government websites. A previous study had not been able to integrate the consequences of web technology used and web contents when assessing user engagement. Furthermore, most studies had used thesurvey and questionnaire with the perceptual measure. An examination of existing components of the websites and their features together with user behaviour preferences while connecting to the websites, had enabled us to conceptualize which best predictors that may be taken into consideration for developing the fittest model of website user engagement, that focuses on better user involvement and participation.

Prior, the implementation of the electronic government according to the United States model had been planned according to presentable online information, online services and form transactions, system integration upon schedule and then real-time responses [1]. Referring to these two sources of evidence [2], [3] showed citizen participation in e-government is still below the targeted percentage value and had a decrement in terms of ranked value. The first stage of preliminary study on website user engagement [4] conducted through an online assessment tool showed that most municipal websites in the Klang Valley, Malaysia had more than 24% bounce rate, less than 5% of daily page views per visitor, and only 3-4 minutes spent on the websites. Factors influencing user engagement such as usability problem and website design are still the subject of contention by researchers [5], [6]. Previous website evaluations focused more on technicality of the websites, such as content quality and performance, with less focus on the primary goal of the websites like government websites, which are supposed to deliver public value as required by the website users [7].

2.0 MALAYSIA GOVERNMENT WEBSITE

One of the new frontiers in the era of semantic web is an adoption of content management activities by connecting data, concepts, applications and people, as well as associated procedures and processes [8]. Malaysia as a developing country has continually established the ICT infrastructure due to the impact and power of ICT towards sustainability of the economy. Below in table 1 is the list of previous studies related to Malaysian government websites.

Table 1. Previous studies related to Malaysian government websites.

Authors & Year	Variable/s	Research Methods
Hussain Shah, Mahmood, Reza Peikari Hamid and M. Yasin, Norjaya, (2014) [9].	Technical protection, Ext. assurance seals, Int. assurance, Website design features and Overall security	Quantitative survey method and data are collected via a cross sectional method.
Wan Mohd Isa, Suhami, Safie, and Semsudin, (2011) [10].	Web Content Accessibility Guidelines 1.0 (WCAG).	Automatic evaluation tools such as Website optimization, Axandra and EvalAccess 2.0 tools.
(Wan Hanafi and Masrek, 2010) [11].	Web Content Accessibility Guidelines 1.0 (WCAG).	An automatic testing tool known is as Bobby.
Anuar, and Othman, (2010) [12].	TAM and additional constructs namely subjective norms, self-efficacy, perceived credibility and amount of information in the research framework	Online survey
Mohd Suki and T ramayah. (2010) [13].	e-Government, Usefulness, Ease of Use, Attitude, Intention to Use, Technology Acceptance Model	Survey questionnaire
Lean, Zailani, Ramayah and Fernando, (2009) [14].	Technology Acceptance Model (TAM), Diffusion of Innovation (DOI) and moderated by culture factor and Trust model.	Survey questionnaire
Mohamed, Norshidah, (2009) [15].	Explicit Knowledge and Tacit Knowledge	Cross-sectional self-administered survey

Review of previous studies on the assessment of Malaysian government websites also tracked that the technology acceptance model (TAM) was prominent and widely used as the theoretical basis or underlying model, which showed the focus was more on acceptance or basic level of website usage. As the Malaysian electronic government was already in the group of high-rank of EGDI [3] and was notified with animpressive acceptance level by usersof the Internet [2], therefore more fit assessment model is needed to adhere and overcome the issues, suchas low utilization and lessuser participation. Here we emphasize to integrate each factor that had separately proven in improving engagement.

3.0 WEB CONTENT MANAGEMENT ADOPTION AND GOVERNMENT MUNICIPAL WEBSITE CONTENTS

Web content management (WCM) has become crucial when most industries accept the use of World Wide Web (WWW) as one important tool in organizations. Current websites and web application had proliferated with providing not only information, but services and online transaction capabilities. Usage of a website today leverages the need for each individual, each business and our society in facilitating towards decision making and enhancing the competitive advantage [16]. Adopting some WCM strategies, such as selecting appropriateness of contents to the target population of onsite visitors and display of the contents attractive to the users will increase engagement [17] between users and organizations.

Content management as a discipline is defined as "the set of processes, technologies, concepts and practices having to do with developing, collecting, managing and publishing content" [18]. Web content management (WCM) is the extension of content management where information resources are on the web enables. Web content management practices evolve when a website routinely uses content management systems either handled by a web master or web content editor. Some tasks that need to be considered and frequently deployed are development of content management system (CMS) requirements, defining of information workflows, dealing with version control, managing the preservation of information (archiving and backup), implementing and optimizing site-search tools and processes, along with defining and maintaining taxonomies, tagging systems, and metadata [19].

In the perspective of government website studies, Redish (2013) [20] stressed that people go to government websites for their contents and thus, good content requires planning that encapsulates the purposes, personas and conversations. However, a huge amount of information contents that need to be included in government websites, specifically on municipal websites, have become complex and rather difficult to get the desired information. Parallel with the function of a municipal organization in serving the citizens and improving city development, municipal government websites can be classified as informational driven websites rich with textual contents, interactive contents, hyperlinks and functional objects [21]. Next, in the table 2 shows different types of textual contents that reside in selected municipal websites.

Table 2. Website contents that reside in selected municipal websites.

Authors & Year	Number of Information Content typology	Information Contents
Lu, Cao and Wang (2010) [22].	7 Sub-indexes	1) History, geography, culture, tourism and other information overview; 2) Investment, enterprise registration, key enterprises introduced and other economic information; 3) Transportation, shopping, medical, schools, hotels, restaurants and other convenient information 4) Government documents, the chief news; 5) Station information, internet search 6) Information time; and 7) The quality of traditional and English versions.
Torres, Pina and Aceretem, (2005) [23].	7 types of other sub-contents	General services (17 sub-contents), Education (2 sub-contents), Environment and Health (15 sub-contents), Housing (10 sub-contents), Social service (5 sub-contents), Economic activities (13 sub-contents) and Culture, leisure and sport (5 sub-contents)
Detlor and et al., (2013) [24].	3 types of other sub-contents	Services (14 sub-contents), Information (13 sub-contents) and application (9 sub-contents)
Miranda, Sanguino and Benegil, 92009) [25].	20 types	Buses; information aboutmuseums, libraries; Cultural information (theatres, cinemas and music concerts); City history; Travel information; Weather forecast; Statistical information; Hospital, fire and emergency information; Public employment information; Municipal laws information; Council meetings date; Budget information; Strategic plan; Municipal organizational chart; Public service information; Tourist information; Investment project information; Security and privacy policy; External links

Besides the element of information contents, it is crucial for municipal government websites to consider the selection of appropriate website design features. As highlighted by Torres, Pina and Aceretem (2005) [23], a government that has reached the

service and delivery maturity level should provide the sophisticated website features, such as error alert, search engine, website map, user validation with digital certificate, e-mail address, e-publication, simplicity of e-filling, multi choices of languages, interactive and friendliness, street map of the city, comprehensiveness of indications for reaching public departments, links to websites of other levels of government and related services, as well as e-democracy aspects that include the following elements: contacting the Mayor and other members of the council, participation of citizens through suggestion boxes and/or complaints about public services to better serve the citizens. In addition, the audience can be attracted through the richness of contents and applications, thus further foster active participation in the websites [26].

4.0 PROPOSED MODEL

The purpose of this study is to examine website preferences and its content characteristics in effect of user engagement. The aim of this study is to get a clear picture of which factors become key to the effective use of the websites. To achieve this aim, the following objectives have been derived:

i. To conceptualize the type of effectiveness measures that will influence user engagement.

ii. To explore current web technology preferences and background of web content management applied as a backend of the municipal websites.

iii. To estimate website content amount, popularity ranking and user engagement level.

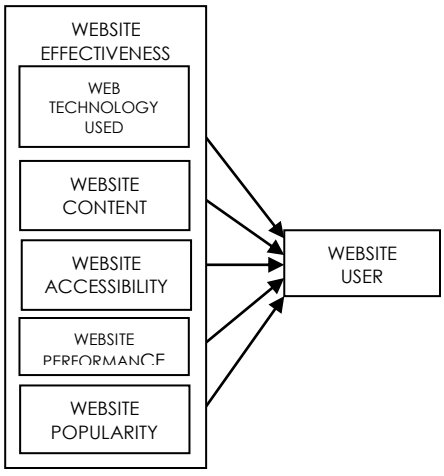

Fig. 1. Proposed research model.

The proposed framework as in figure 1 was drawn based on adaptation from: Accessibility: Youngblood and Mackiewicz (2012) [27]; Katre and Gupta (2011) [28], Popularity: Olteanu, Peshterliev, Liu and Aberer (2013), Website content, web technology used website performance: Butkiewicz, Madhyastha and Sekar (2011) [29].

Website User Engagement

The term engagement has been defined as the situation being involved, occupied, retained and intrinsically interested in something [26] while user engagement has been defined as the emotional, cognitive and behavioural connections affecting a user while using the resources [30]. User engagement has also been related to user experience which includes characteristics such as increased attention, positive effect, sensory and intellectual satisfaction and mastery [31], [32]. However, online evaluation tools like Alexa.com, [33] used measures of page views, time on the site and bounce rate as measures of website effectiveness. Another study, Wang, Li and Zhang, (2011) [34] had utilized most of the measures from metric tools and one measure is from Alexa.com engagement measures; Page View, Bounce Rate and Time named as Page Interest.A recent study, Oliveira Huertas And Lin (2016)assessed user engagement in the context of social network, and they found four significant factors:a) subjective norm, b) social identity, c) entertainment value, and d) maintaining interpersonal interconnectivity. Most previous studies that assessed user engagement had used user behaviours to the related system context and its functionality. Thus, this made user engagement measures unique and applicable only to the related information system.

Website Effectiveness

According to the Oxford dictionary, the term effectiveness is the degree to which something is successful in producing a desired result or aim. Website effectiveness has also been defined as the overall impression of the site and the likelihood of revisiting [35]. In the aspect of website design, Thea van der Geest and Eric Velleman (2014) [36] encapsulated the effectiveness as part of usability outcome together with efficiency and satisfaction in achieving a reader's specified goals with particular text content in the website. Previous literature related website effectiveness with page loading speed, appropriate content selection, navigation efficiency, security, targeted users and website design [37].

Website effectiveness has also been related to tracking of hits or number of visitors [38] as the researcher understood that measuring the success of websitesis similar to measuring the success of anyservice, and in the context of websites, the

number of keystrokes and mouse clicks can be registered as a vote. Schmidt, Cantallops and Santos (2008) [39] evaluated the hotel website characteristics as performance indicators in measuring the website effectiveness. Another travel website study had used measures from engagement in Alexa.com automatic tools for examining website effectiveness [33]. Thus, a variety of measures and sub-measures need to be examined in order to arrive at appropriate factors contributing to the frequent use of different types of websites, in the case of this study,the context is the local government websites.

Web Technology Used

Nowadays, web technology and implementation strategies have also been said as contributing factors to website performance, as 60% of websites have contents from at least 5 non-origin sources,and these contribute more than 35% of the bytes downloaded. Performance measure such as load times had also been identified to correlate with the number of servers used for the website [29].

Website development have proliferated and had been embedded with interactive components to adapt interactive, integrative and intuitive characteristics [40]. The web technology characteristics of websites basically include security, mode of navigation, search facilities, site availability, valid links, personalization, the speed of page loading, interactivity, and ease of accessing the site. Rapid changes in the web technology do not only affect the website development processes, but indirectly also affect user behaviour and perceptions as a result of these changes. Thus, it isessential to study the impact of web technology used in website development in effecting upon user engagement.

Web Contents

Website content is defined as the presentation and layout of the information and functions that capture the overall firm presence and its public image [41]. Previously, most website studies related to contents or information contents had specifically used quality measurement in relating to the measure of success factor or user acceptance [42], [43]. Aladwani (2006) [43] had classified four dimensional views of the website quality such as technical quality, general content quality, specific content quality and appearance quality. Website content has also been said to have an effect on how customers perceive the web service quality, in which the constructs include information quality, appropriateness of the amount of information, types of media, presentation mode, size and types of the images, and the overall appeal of the website. Using different variable terms, [44] formulated a dimension of content strategy which contains independent variables that include content type, content agility, posting day and content context to determine customer engagement.

Web Accessibility

In the context of government websites, accessibility has always been understood as a guarantee of equal or equivalent access to public information and e-services for all users, supported with assistive technologies required for groups of users with different disabilities. Accessibility measure had always been part of web evaluation measures of government websites [45], [28]. In the Malaysian context, Bobby automated testing tool and EvalAccess 2.0 had been used as both tools were in conformance to the Web Content Accessibility Guidelines 1.0 (WCAG 1.0) [11], [10]. Currently, the World Wide Web Consortium (W3C) had established Web Content Accessibility Guidelines (Note 2) – WCAG 1.0 and 2.0 which regulate universal accessibility to website contents. Accessibility is considered as the main factor in determining the measure of effective websites as it had become the main or frontline criteria to accessing the contents in the websites. The provision of alternative texts to images, identify empty links, page title existence and length, breadcrumb links are examples of accessibility measures checked within WCAG 1.0 and 2.0. The use of automatic or online evaluation tools of accessibility checker is widespread today due to its benefits to both users and designers specifically time-saving, being assistive and following the standard of universal accessibility guide [45], [46].

Web Performance

Websites with better usability and quality perceptions deliver the highest performance [47]. Chatzopoulos & Economides (2009) [48] used GovtQual measure which includes 13 categories of measures: 1) Content, 2) Presentation, Media & Format, 3) User Interface, 4) Structure & Organization, 5) Navigation, 6) Orientation, 7) Interactivity & Feedback, 8) E-Services & Applications, 9) Reliability & Availability, 10) Maintainability, 11) Performance, 12) Openness, Compatibility & Interoperability, and 13) Security, together with data from automated metric tool WebXact to determine any broken link and error on page by examining fifty Greek municipal websites. In evaluating academic website, Using two evaluative online tools, the researchers included the performance measures of short waiting time to download a file or open a page; ease of distinguishing between links visited and not visited; accessibility to the website most of the time; expected time of website response; efficient to use the website; and clear and useful message to finish the tasks [49].

Website Popularity

Website popularity had always been calculated as the number of visit traffic. Alexa.com is an automated metric tool and known as website popularity rating that can provide a quick preview of the popular or unpopular websites [50], [51]. One empirical study on ranking showed a weak correlation between e-government website ranking scores and website accessibility [52]. Olteanu, Peshterliev, Liu and Aberer (2013) [53] measured features of web textual content, link structure, web page design, as well as their social popularity to select the most informative features. Another researcher, Scharwz and Morris (2011) [54] had used alexa.com ranked as an off-page credibility feature in the sub-category of an award to show general popularity on web page visualization compared to search result visualization, and the study proved that visualization made a significant impact on participants' ability to evaluate credibility.

Alexa.com can be used to measure popularity, either ranked by world or within Malaysia. For ranking within Malaysia, traffic count will be a rough estimate ofthe site's popularity It is calculated using a combination of average daily visitors to thesite and pageviews on thesite from users in the country over the past three months average data. The site with the highest combination of visitors and pageviews is ranked as first ranking #1 in that particular country.

5.0 METHODS

This study applied investigative and self-evaluative method as used by Fogg et al., (2003) [55], Jayasundari and Jeyshankar (2014) [56] and Khatri & Baheti, (2013) [57]. This method included literature review, designing a checklist or criteria and hands-on evaluation of the websites using online tools. For the purpose ofreporting in this article,only first and second steps were included and discussed. Table 3 below shows the steps, tools and objectives of the preliminary study.

Table 3. Steps, tools and objectives of the preliminary study.

Steps and tools used	Objective
A literature review of effectivegovernment websitemeasures	To conceptualizetypes of effectiveness measures that will influence website user engagement.
Self Evaluation of ten municipal websites using web metric tools. i. Website profiler name Builtwith http://builtwith.com ii. Web analytic metric tool https://www.webpagetest.org/ and Alexa.com	To explore current web technology preferences and background of web contents management applied as backend of the municipal websites. To estimate website content amount, popularity ranking and user engagement level.

6.0 FINDINGS AND DISCUSSIONS

As a result, in examining user direct attitudes and behaviour via online evaluation tools, it was shown that most municipal websites have used the same CMS, open source platforms and analytical tools in managing their web contents and website development,with the exception of one or two municipal websites that used different platform to integrate with their core. Most websites contain large contents which include images, java scripts, font property, stylesheet documents and HTML tags. Table 4 list all web technology profile that used by ten selected municipal websites.

Table 4. Web Technology Profile using (Builtwith.com)

M'sia M'cipal Website	Web server	CMS Used	Framework	Analytical & Tracking
M1	Apache	Joomla!	ASP.Net	Google Analytic
M2	Apache	Drupal7	PhP	Google Analytic
M3	Miscrosoft IIS solution	Drupal7		
M4	Apache	Drupal7	PhP	Google Analytic
M5	Microsoft IIS 8 Server solution.	Microsoft SharePoint Server 2013	ASP.NET	Google Analytic
M6	Oracle Application Server	-	-	-
M7	Apache	Drupal7	PhP	Google Analytic
M8	Apache	Drupal7	PhP	Google Analytic
M9	Apache	Drupal7	PhP	Google Analytic
M10	Apache	Liferay	J2EE	Google Analytic

Web server and content management system that mostly subscribed is open source web server namely as Apache and Drupal Web content management. Google analytic is the web analyzer that preferable by the municipal website in analyze their website performance.

Website content the normally resided in the website are varies such as images, tenxtual and audiovisual content. Using Web analytic metric tool

Webpagetest, identification of five types of web content such as image, javascript cascading stylesheet, font property and html content in the ten municipal website, however in table 5 below excluded the figure of font content amount due to not all mucipal have the figures.

Table 5. Web Content Amount in bytes

M'sia M'cipal Website	Image	jss	css	html
M1	1,548,720	248,161	48,334	24,383
M2	10,905,786	503,024	801,308	18,334
M3	1,378,994	491,852	43,435	46,541
M4	3,797,837	206,251	85,357	23,344
M5	7,891,614	341,229	82,287	36,801
M6	1,285,715	142,927	56,472	26,879
M7	674,042	140,269	83,972	22,820
M8	2,576,460	163,374	85,226	85,226
M9	4,033,194	162,607	85,313	23,142
M10	8,920,069	181,577	51,037	17,163

Among these four types of web contents, image content was the biggest contribution in terms of bytes, i.e. Municipal M1, M8 and M5 respectively. Even though municipal M1 had the highest rank of total bytes of all types of contents, M1 was only second highest rank in popularity among these 10 municipals. Different with M8 ranked second highest in the web content amount but was the lowest ranked in popularity, with the count based on web user traffic in Malaysia. M5 was however listed on the high amount of website contents, and could still achieve a middle range of popularity ranking in Malaysia as compared to these 10 websites.

The results of popularity and user engagement behaviour from Alexa.com metric evaluation was estimated based on page views percentage, the bounce rate, i.e. the percentage of users who only entered the first page of the website and then turned off, and user duration on site in minutes and second. Table 6 below show the detail of municipal ranked in Malaysia monthly traffic ranking, percentage of page view per user, bounce rate and duration of time user on site in munite and second.

Table 6. Web popularity & Engagement

M'sia M'cipal Website	Malaysia Monthly traffic ranking	Pageviews / User (%)	Bounce Rate	Time on Site (minutes: sec)
M1	2476	4.5	32.40%	5:16
M2	2950	6.1	20.40%	5:45
M3	6335	5.5	16.80%	5:52
M4	6734	4.8	30.50%	6:31
M5	7741	4.5	30.50%	3:48
M6	7783	2.6	57.20%	3:38
M7	10,444	3.6	28.60%	3.22
M8	10701	4.6	26.80%	4:11
M9	12837	3.9	24.10%	6:51
M10	13,928	4.6	20.30%	4:24

Six municipals M10, M1, M3, M5, M9 and M7 had listed below than 7000 popularity ranking in Malaysia as compared to other 4 municipals M2, M6, M8 and M10 that ranked far beyond ten thousand popularity ranking in Malaysia. Municipal M2 had the highest rate of page views at 6.1%, followed by M3 with 5.5% and the rest M1, M4, M8 and M10 earned approximately 4.5% to 4.8%. Only M9, M7 and M6 showed the least percentage of page views, as low as 3.9%, 3.6% and 2.6% respectively. Among 10 municipal websites that had been investigated, M6 earned the highest bounce ratereaching 57.2% by the time evaluation was completed, whereas M3 showed the lowest bounce rate at 16.8%. Municipal M1, M4, M5, M7, M8, M9 and M10 had 32.4%, 30.5%, 30.5%, 28.6%, 26.8%, 24.1% and 20.3% respectively, in which websites with more percentage of bounce rate showed that less users continue to use the websites or go deeper into the websites.

The duration that users spent on the websites in terms of minutes and seconds (m:s), Municipal M9 and M2 obtained the highest at 6m:5s and 6m:3s, whereas Municipal M3, M1 and M10 recorded 5m:52s, 5m:45sand 5m:16s duration respectively. While the others, Municipal M8, M6, M5, M7 and M4 had users on site between 4m:24s to 3m.22s. The duration of time spent in these municipal websites were similar as previous year's results of the study.

Based on the discussions above, the study of appropriate CMS usage, amount of content elements and website popularity of government municipal websites can be further investigated to confirm whether those are the significant measures. Perhaps, integrating with other measures suchas accessibility and website performance may fit inwith designing of an effective government website model. Through the literature review, emphasizing on the content strategy and aligning with the aim of municipal websites in serving users with the valid information and fast services are imperative. Thus, the importance of planning and justifying specific contents need to be included in a municipal website as had alsobeen proposed earlier [58]. Table 4 at the end of the article lists the findings of web technology used, web content amount, website ranking and user engagement value based on assessments conducted–on 28th and 29th September 2016, and 3rd October 2016.

7.0 CONCLUSION

This study provides an overview of the factors that contribute to website effectiveness. Measures such as web technology used, the web content amount and website popularity can be further studied to determine how it influences users to delve deeper into the websites. These three factors may also have a connection with other measures such as accessibility and web performance. This study may signify to any web content management team certain preferences in design and maintaining of their websites. In terms of method, the use of online evaluation metrics or tools is competitive and practical due to its fast retrieval, cost savvy and variety of choices. In future, it is advisable that similar methods and measures be used for numerous websites for improved findings and analysis of the results.

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