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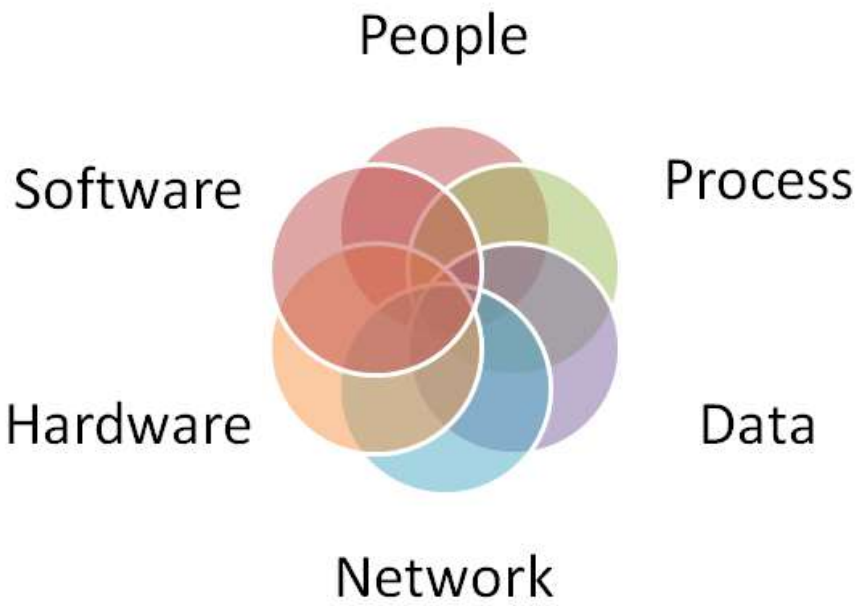

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Institut Teknologi Sepuluh Nopember (ITS) – Surabaya
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A survey of Web Technologies used in Indonesia Local Governments

Nur Aini Rakhmawati*, Sayekti Haris, Deny Hermansyah, Muhammad 'Ariful Furqon

Information Systems Department, Faculty of Technology Information and Communication, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia

Abstract

Indonesia has 548 local governments (34 provinces, 349 cities and 91 municipalities). One of implementation of e-government is providing local government information through an official website. Therefore, we investigate 548 official websites of local government in Indonesia including a list of web technologies such as web server, web programming, CSS framework, Content management system, web framework and web 3.0. To collect data about local government websites, we did a survey with the help of Wappalyzer. Each website should be visited and checked by Wappalyzer. In general, the technologies used in official local government website are the widely known in the world as well. There is a lack of implementation of web 3.0 to build Indonesia local government, particularly in government-related vocabularies.

Keywords: Indonesia, Local Government, Web, Website

Abstrak

Indonesia memiliki 548 pemerintah daerah (34 provinsi, 349 kota dan 91 kotamadya). Salah satu implementasi dari *e-government* adalah menyediakan informasi pemerintah lokal melalui situs web resmi. Oleh karena itu, kami menyelidiki 548 situs web resmi pemerintah lokal di Indonesia termasuk daftar teknologi web seperti server web, pemrograman web, CSS, sistem manajemen konten, *web framework* dan web 3.0. Untuk mengumpulkan data tentang situs web pemerintah lokal, kami melakukan survei dengan bantuan Wappalyzer. Setiap situs web harus dikunjungi dan diperiksa oleh Wappalyzer. Secara umum, teknologi yang digunakan di situs web resmi pemerintah lokal juga dikenal luas di dunia. Web 3.0 belum terimplementasi dalam pembanguan situs pemerintah daerah Indonesia khususnya dalam kosa kata terkait pemerintah.

Kata kunci: Indonesia, Pemerintah Daerah, Web, Website

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*Corresponding Author
Email address: nur.aini@is.its.ac.id (Nur Aini Rakhmawati)

1. Introduction

Recently, development of website technology has thrived. Website technology has grown from Web 1.0 to Web 3.0 [1]. Web 1.0 is known as read-only web or web of cognition. While Web 2.0 is defined as read-write web. The latest web technology, Web 3.0 is well known as semantic web. Web 3.0 or semantic web allows a machine to understand the structure of the existing website which information is given is well-defined meaning [2]. Web 3.0 or semantic web can prevent disambiguate of information that is not provided by Web 1.0 or Web 2.0 [3]. Furthermore, the technology which is used on a website has evolved with the development of website programming languages. Some web technologies such as JavaScript, web framework, and CMS have flourished and have been widely used by web programmers to develop a website. Moreover, the infrastructures used in developing a website are also evolving such as web servers and operating systems.

Web 3.0 or commonly known as Semantic Web combines the benefaction of Web 1.0 and 2.0 by adding machine intelligence. In Web 3.0, the machines get along with users in content production and in decision-making, transforming the traditional supportive role of the internet infrastructure to an entity in content/process generation. Machine intelligence usage on the semantic web makes information is categorized and stored in such a way that a computer can understand it as well as a human. Thus, Web 3.0 services can unite users and computers for problem-solving and intensive knowledge creation tasks. Therefore with its large processing capacity, Web 3.0 is able to bring services and products to people and businesses [4].

Indonesia is at 4th rank of the most populous country in the world and has 548 local governments that govern those citizens [5]. The structure of the Indonesian government is divided into several local governments that include the provincial government and municipal or district governments. Each local government has an obligation to provide information to the citizens in relation to general information such as activities, policies, rules and other information needed by the citizens. So every local government must provide e-government both in the form of websites or social media which is used to disseminate the information to the citizen to realize open government that includes collaboration, open data, transparency data, government transparency, and participation [6].

Mostly local governments in Indonesia already have e-government website that has been well developed using web technologies such as JavaScript, web framework, and CMS. It has also been well developed using website platforms such as web servers and operating systems which is used on servers. Technologies may influence the performance of websites. [7] shows that the speed of 30 websites province in Indonesia is very low. In terms of the content of the websites, our previous study [8] revealed that less than 60% of the official websites of local governments that can provide the information as stated in Indonesia Government regulation.

This study about implementation of innovative applications of Web technology might advance local governance reform as it is still not found in Indonesia such as web server, web programming, CSS framework, Content management system, web framework and web 3.0. The purpose of writing this paper is to carry out of a survey that identify the technology used on the website, the platform used on the website, and semantic components used on the website of 548 Indonesia local governments. The objective of the survey is to investigate of penetration of web technologies in Indonesia local governments without asking the web developer of their website.

The rest of the paper is structured as follows: Section 2 presents several studies and works that paper which evaluates the diversity of web technologies and evaluates the local government web. Then, we describe Indonesia as our case study and the existing local governments that we have evaluated for its websites. Section 3 explains the literature associated with the platform, web technologies, and Web 3.0 or semantic

web. Next, the statistical local government websites are described in Section 4. The results of statistical local government are analyzed and explained on Section 5. Finally, we conclude our works in Section 6.

2. Related Works

Empirical research on how e-government is implemented effectively at the municipal level. A basic conceptual exploration study of a framework for the development of e-government and the effectiveness test of e-government in municipal governments based on a comprehensive survey data from a 2000 e-government survey conducted by the International City/County Management Association and Public Technology Inc. It's contribution to the development of e-government at the local level based on 2 primary institution factors (size and type of government). Survey results show that size and type of governance is an important institutional factor in e-government development [9].

The municipal sites are public and some are private. The information is not so specific to the city government, this site also displays entertainment, business, or economic information related to city jurisdiction. The municipal sites in California integrate theories in the fields of economic politics, communications, and public administration in developing a framework with a conceptual alternative approach to governance reform [10].

Another study uses the ICMA Electronic Government Survey 2002 data sent in the spring of that year with the total population of 2500 municipalities, the total population of the district as much as 2500. This study uses the method of frequency testing of two-stage incidence model on different types of government relations. The statistic tool used is SPSS version 11.5 to generate descriptive statistics [11].

This study would like to answer the question of municipal website involvement with the governance of public facilities and the extent to which the business of the city of U.S. to make it happen. This paper reports a 2004 survey analysis of government websites in key cities of the 100 metropolitan areas of the U.S. the biggest. The survey reviewed over 3,000 web pages on government sites to determine their capacity to facilitate local community involvement [12].

Our research is about web technology used by local government in Indonesia. The focus of his research in the technology used, the example server used, the CMS used, the javascript used, the web framework used, and others.

3. Web Technologies

The information at this time is widely disseminated using the world wide web (www). By using world wide web, the information is only needed to be represented once and allow the topology of the information to evolve [13] Web technology at this time has grown rapidly along with the increasing number of access on the world wide web. Web technologies that are often used include javascript, web framework, and CMS which is further discussed in the following section.

3.1 Web Server

Web server is the most important thing in web technology, without web server then the web will not exist, because the web server is like home or place of the web store. Web server itself there are various kinds, namely Apache, NGINX, IIS, LiteSpeed, GWS. The most popular Web server used is Apache, followed by NGINX. Both web servers are the most popular web servers among users of web technologies. A more detailed discussion will be presented at the next section.

3.2 Java-Script

JavaScript is a scripting language which is have proven their usefulness in various application areas [14]. JavaScript (which is often shortened to JS) is a lightweight, interpreted, object-oriented language with first-class functions, and is best known as the scripting language for Web pages, but it is used in many non-browser environments as well. JavaScript runs on the client side of the web, which can be used to design or program how the web pages behave on the occurrence of an event. JavaScript is easy to learn and also a powerful scripting language, widely used for controlling web page behaviour. Because of the increasing use of Web 2.0, so the user demand associated with sophisticated user interfaces and client-side browser functionality will also increase. As a result, JavaScript has become a crucial factor for both browser vendors and Web app developers to develop some websites based on Web 2.0 and above. The development of websites or mobile apps at this time that is based on HTML5, as it is entirely possible that JavaScript will become a dominant programming language for both mobile and desktop applications [15].

3.3 Web Framework

Web application frameworks, or simply "web frameworks", are the de facto way to build a website. When starting a development of a website, developers and project managers make certain decisions in the development process. One of those decisions is whether to develop the website using web frameworks or to develop the website from scratch [16] Web framework allows website developers to develop a website based on available resources which are provided by the web framework including web services, web resources, and web APIs. Based on the function, web framework is divided into three types, that is CSS Framework, JavaScript Framework, and PHP Framework. CSS frameworks are packages containing pre-written, standardized code in files and folders. They provide a base to build on while still allowing flexibility with the final design. The primary function of JavaScript frameworks is to provide RESTful API services.

3.4 Content Management System

Content Management System or well known as CMS is defined as a system that lets web developers to apply management principles to the content [17]. Generally, all CMSs satisfy the common task of content like create, edit, and publish. Beside, CMSs are providing good user support, security, more plug-ins, documentation etc. The example of CMSs which are usually used on website development are Wordpress, Joomla, Drupal, etc.

3.5 CSS Framework

At present, there are many CSS framework developed to assist a web developer in designing a website that is using Cascading Style Sheets language. Moreover, the framework is required for a web page to adapt in different of screen resolutions. According to [18], Twitter Boostrap is the most popular CSS Framework now.

3.6 Web 3.0

Web 3.0 technology was developed by Tim Berners Lee based on the idea of how data or information residing on the web could be understood by the machines [19]. Web 3.0 is also known as Semantic web because web 3.0 allowing computer to understand the "meaning" of data instead only displaying the data [20]. Semantic web usually works with a Resource Description Framework (RDF) as a framework to describe the information and construct metadata as the basic building block for semantic web [19, 21]. RDF is written in XML format and describes resources of data in the form of triple which consists of the subject, predicate, and object. On the other hand, Schema.org provides a vocabulary which can be used to describe data for a linked data. Schema.ORG is a set of a web page which provides a single schema across a wide

range topic [22]. Nowadays, schema.org has been used by a major search engine providers including Yahoo, Google, Bing, and Yandex [23].

4. Statistical Local Government Websites

To collect a data about local government websites, we did a survey with the help of Wappalyzer (https://wappalyzer.com/) application. Wappalizer is a multiplatform tool used for identifying technology used on websites including servers, content management systems, eCommerce platforms, analytics tools, advertising frameworks, etc. There are limitations to the data obtained because of the limitations of the Wappalyzer that cause the Wappalyzer cannot detect some parts of the web technology being used.

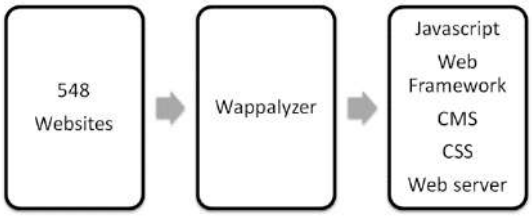

Figure 1 Methodology

As shown in Figure 1, we have surveyed a total of 548 local government websites. We identify a technology used by local government websites including JavaScript framework, web framework, CMS (content management systems), web servers, and operating systems.

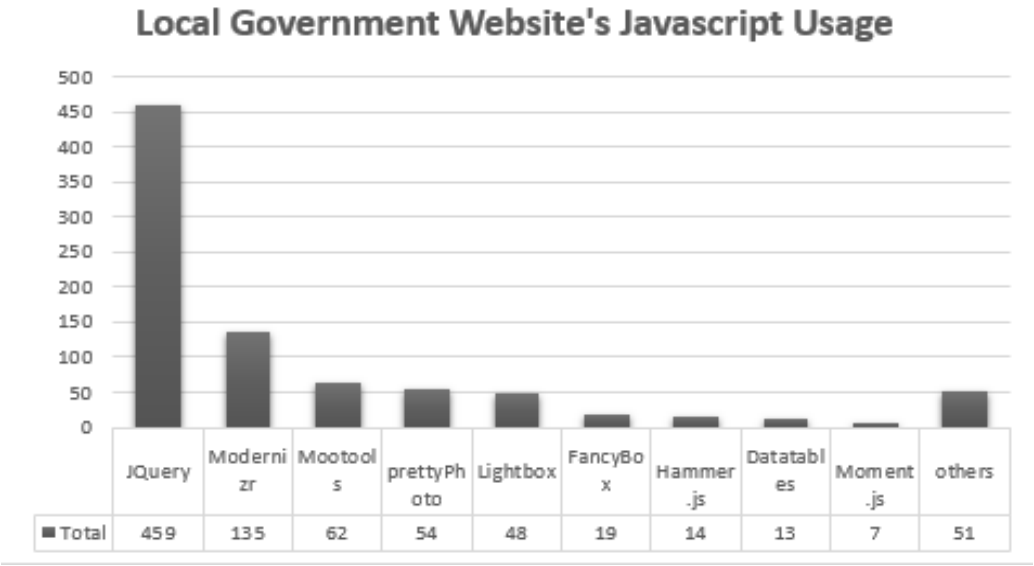

Figure 2 Javascript frameworks used in Local Governments Website

Figure 2 shows that JQuery (https://jquery.com/) is the most popular JavaScript framework used in local government websites followed by Modernizr (https://modernizr.com/) which is used to detect the user's browser and deliver the best experience for the user. As seen on Figure 2, a single website consists of more than one JavaScript frameworks. On the one hand, a JavaScript could assist a web development, on another hand It could reduce a web page loading time.

Local government websites surveyed are mainly developed by three ways including coding from scratch or without using any framework or CMS, by using Web Framework, and by using CMS. There are two type of web framework identified, general web framework and front-end web framework. General web framework is a web framework which is used in web development in wide range area from back-end development to front-end development as such as Laravel (https://laravel.com/) and Code Igniter (CI) (https://codeigniter.com/), while, front-end web framework is a specialized framework to boost the development of website's user interface as such as twitter bootstrap (http://getbootstrap.com) and ZURB Foundation (https://foundation.zurb.com/).

Some local government websites are also developed using CMS which considered cheaper and faster than developing those websites by using a framework or coding from scratch [24]. Although we found some CMS based websites also implemented a front-end web framework to enhance the user experiences, there is no website which implements general web framework and CMS at once.

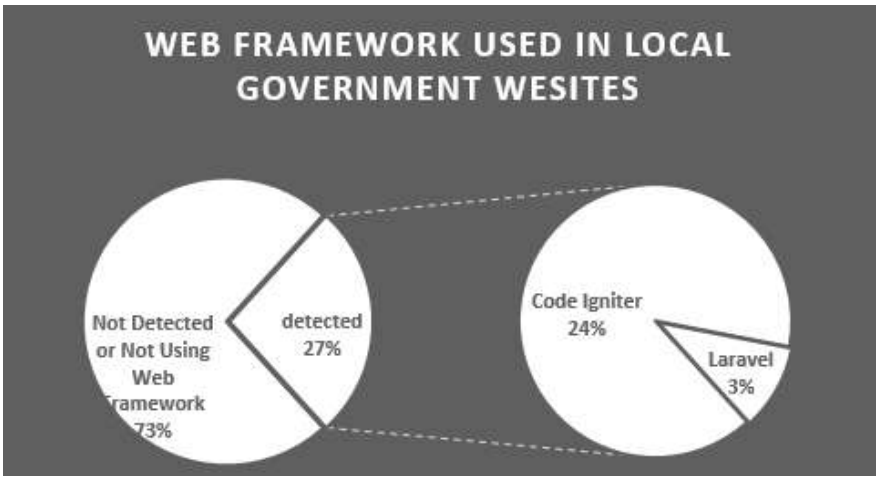

Figure 3 Web frameworks used in Local Governments Website

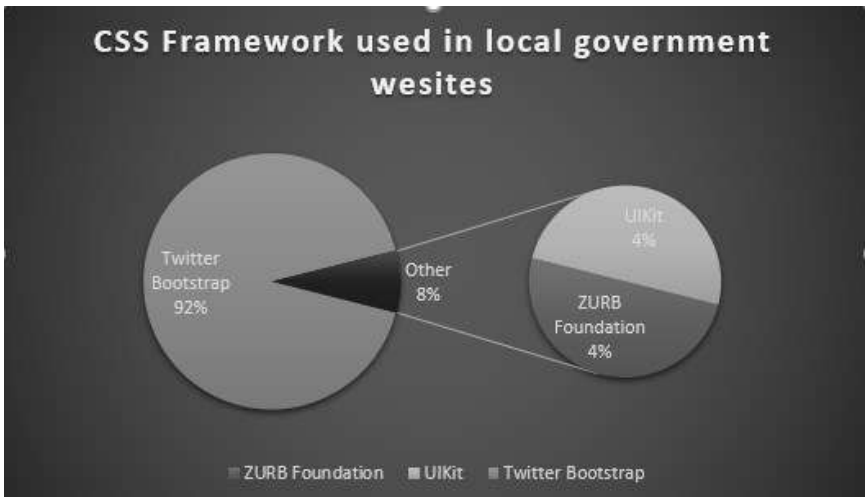

Figure 4 CSS frameworks used in Local Governments Website

Based on our survey results, Figure 3 shows that CI is the most used web framework in local government websites since CI is one of the oldest popular web frameworks that has been released. On the other hand, Figure 4 explains that twitter bootstraps are the most used CSS framework since it easy to integrate with either web frameworks or CMS. Figure 5 shows that Wordpress (https://wordpress.org/) is the most popular CMS followed by Joomla (https://www.joomla.org/). In this paper, our survey result also indicated that Apache server is the most common web server used followed by Nginx which can be seen in Figure 6.

We also surveyed if a GovernmentOrganization's schema from the schema.org is available, but we found out that none of these local government we surveyed is using it. The only schema found on our survey is focused around blog post, image object, and web page topics.

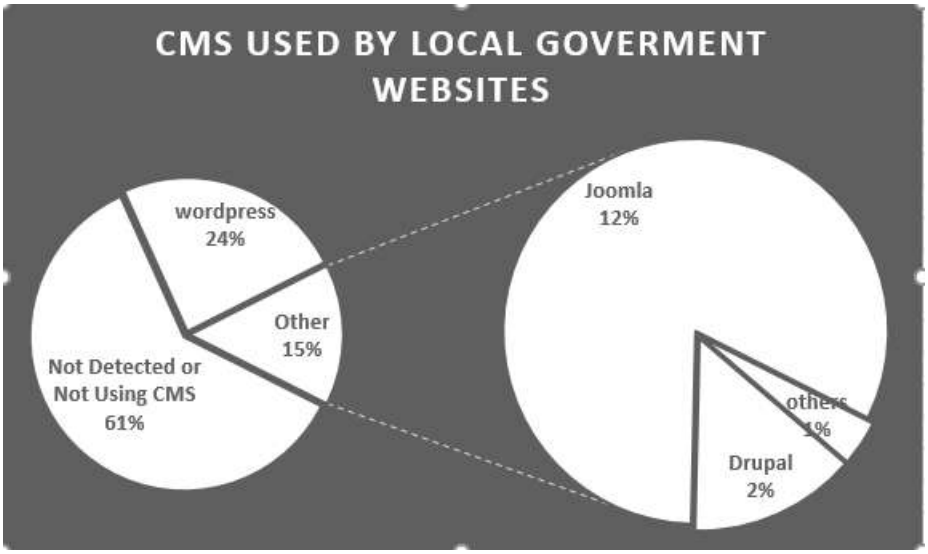

Figure 5 CMS frameworks used in Local Governments Website

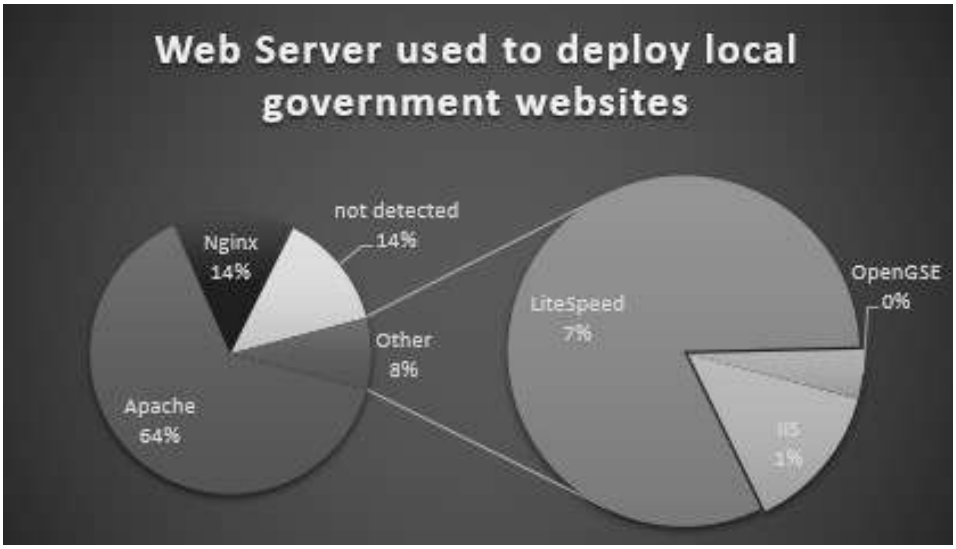

Figure 6 Webserver used in Local Governments Website

5. Discussion

According to [25], Apache and Nginx are two of the most popular web server in the world. In general, local government website pages are static content, therefore Nginx could be a better choice since [26] stated that Nginx performed better than Apache while using static files. The most web servers used are web server that can execute PHP since the web technologies used by the local governments (CMS and web framework) are based on PHP.

Twitter Bootstrap offers many more features such as grid system, navigational tools than other CSS frameworks. Moreover, Twitter Bootstrap gains high popularity in Indonesia local government and in the worldwide. ZURB Foundation takes the second place after Bootstrap for the most popular CSS frameworks [18].

Recently, JQuery is the most notable JavaScript Framework, which more than 90\% of website use JQuery [27]. According to [28], YUI3 and JQuery are difficult to maintain. However, the execution time of JQuery and Mootools are fast. A single local government website consists of more than one JavaScript frameworks.

Maintaining a website is not a trivial task, therefore, people set up a CMS to create a website quickly. In 2017, Wordpress, Joomla and Drupal are the most CMS in the market share of CMS in the world [29]. Those CMSs are also mostly used in Indonesia local government website. The investigation of G2 Crowd [30] reports that Wordpress is categorised as Products in the Leader quadrant while Joomla is one of the products that highly rated by users.

Laravel and CI are two PHP frameworks that are widely known used in the worldwide. [31] proved that CI performs well. Laravel provides many features for web development that adopts Model-View-Controller style [32].

In terms of implementation of Web 3.0, the schema.org is found in a few websites which is given by either the CMS or CSS framework. No local government embeds schema.org for explaining the government content. Semantic approach is needed to realise open government for local government in Indonesia by incrementally generates Linked Government Data (LGD) for Indonesia government [33]. By using Linked Government Data, it can support public participation as has been done in the cities of the United States [12].

6. Conclusion

In this paper, we have investigated the web technologies used in 548 Indonesia local governments including web server, CMS, CSS framework, Javascript framework, web framework and web 3.0. In general, the technologies used in official local government website are the widely known in the world as well. The websites are not built from scratch, but their web developers have been employing several frameworks in developing the websites. There is a lack of implementation of web 3.0 to build Indonesia local government particularly in government-related vocabularies. Therefore, schema.org should be implemented in the websites. This approach is needed to realise open government for local government in Indonesia by incrementally generates Linked Government Data (LGD) for Indonesia government.

In the future, we will carry out a survey to the local government website developer opinion regarding their technologies preferences while developing a website.

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