



A study of government 2.0 implementation in Indonesia

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ABSTRACT

Web 2.0 has brought innovations in digital government, namely, government 2.0. Social media, as one part of Web 2.0, could potentially support fuller participation and public interaction. Social media enjoys a very high level of acceptance by individual users and government agencies around the world. Web 2.0 and social media usage in the public sector still needs to be tested from the perspective of not only the government but also the community as the recipient of services. Therefore, this study aims to answer the following research questions: How effective has government 2.0 implementation been in Indonesia? Is there a correlation between e-government management and government 2.0 implementation? We adopted the sophistication index (SI) by Bonson et al. (2012) [1] to answer the first research questions. The SI examined the presence of Web 2.0 features and social media applications on these government institutions' websites. As to answer the second research question, we conducted parametric statistical tests to assess how e-government implementation, based on the Indonesian E-Government Rating (PEGI) score, has influenced the effectiveness of government 2.0 use by government institutions in Indonesia. We observed the websites and social media accounts of 116 Indonesian government institutions. According to the evaluation of Web 2.0 and social media use, the average SI score is 42%. These results indicate that, in general, government institutions in Indonesia have used Web 2.0 and social media features, although the adoption rate has not been equal. The correlations between the PEGI scores and SI values also suggest a positive relationship between the effectiveness of e-government implementation and the effectiveness of government institutions. Therefore, government institutions that have been effective in implementing e-government have also been effective in implementing government 2.0.

1. Introduction

Government 2.0 is an innovation based on Web 2.0. Utilization of Web 2.0 technology has substantially transformed how governments can operate and enhance their existing intra-organizational work practices [2]. Additionally, with characteristics that support participation, government services through Web 2.0 have the potential to transform how governments provide services and how relationships between the government and society look [3]. Social media has built the ideological and technological foundation of Web 2.0, which allows the creation and exchange of user-generated content [4]. Social media has four main advantages, namely, collaboration, participation, utilization, and time [5]. Collaboration and participation are the primary characteristics of social media that allow users to connect and form communities as a

forum for sharing information, socializing, or achieving common goals. As part of the techno-social system, social media provides a platform for users to voice their aspirations effectively, efficiently, and in real time. Social media has achieved phenomenal growth in recent years, resulting in an extraordinary accumulation of information generated by users [6, 7]. Increased use of social media allows people to connect, interact, and collaborate [8]. As a result, many government agencies have adopted social media as part of their e-government initiatives. The use of social media by government agencies continues to increase around the world: 118 countries have used social media as part of e-government initiatives, with such initiatives increasing 50% from 2012 to 2014 [9].

In Indonesia, Ministry of Administrative and Bureaucratic Reform regulates the utilization of social media by government agencies for information disclosure, collaboration, and community participation

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[10]. The regulation states that public relations agencies should communicate policies, work plans, and performance to the broader community through traditional media,¹ conventional media,² and new media³ (in this case, social media). The regulation referred to social media because it can directly and quickly reach all parties [10]. According to a survey of 2277 adult internet users in the United States, two-thirds of adults in online communities use social networking sites [11]. In Indonesia alone, the Indonesian Internet Service Providers Association (APJII) has noted that by the end of 2016, the number of Indonesian netizens reached nearly 143 million, up 10 million compared to 2015 [12]. Internet users in Indonesia mostly use social media, and on average, users are still young [12]. In Indonesia, the social media sites Facebook, Twitter, and YouTube are the most visited sites [13]. The number of social media users has grown linearly for both individuals and government agencies. There is a 50% increase in social media use by government agencies in the world from 2012 to 2014, and the number of individual users would also increase to 2.55 billion in 2017 [9]. Given that fact, it would be unfortunate if the government could not realize the potential of social media for e-government.

Research on the implementation of Web 2.0 by governments is still relatively new, with researchers using qualitative, quantitative, and combined methods [14]. Other case study tested and analyzed the potential of social media services to help the Traffic Management Center of Polda Metro Jaya improve the effectiveness and efficiency of public services, as well as the quality of relations between the government and the public in Indonesia [15]. Another study evaluated the use and impact of Web 2.0 technologies in UK local government [2]. The researchers developed a framework to determine the effect of the benefits, costs, and risks of Web 2.0 on local government authorities. The findings showed that Web 2.0 has both positive and negative impacts on the government. Moreover, traditional ICT evaluation criteria and techniques apply to Web 2.0 innovations in e-government [2]. [1] developed a method for evaluating the use and effectiveness of government 2.0 services and used the approach to evaluate government 2.0 services in EU local governments [1]. Using the method from Ref. [1]; another study concluded that Facebook, Twitter, and YouTube are the most widely used social media applications by government agencies in Egypt and that they are mostly used only to disseminate information, rather than as a medium of interaction between the government and the public [16].

On a technological level, creating social media accounts is relatively simple. However, it is more difficult to manage these social media accounts to provide public benefits [9]. As related initiatives represent the latest technological advancements, the use of Web 2.0 and social media in the public sector still needs to be evaluated from the perspective of not only the government as a service provider of government 2.0, but also the community as a recipient of government 2.0 services. The questions answered by this research are as follows: How effective has government 2.0 implementation in Indonesia been? Is there a correlation between e-government management and government 2.0 implementation? To answer the research questions, we adopted the method of [1] to observe websites and social media from 116 government institutions in Indonesia. The first step was to examine the presence of social media applications on these government institutions' websites. The second step was to conduct parametric statistical tests using SPSS 22.0 to analyze the effect of e-government implementation on the effectiveness of

government 2.0, based on the Indonesian E-Government Rating (PEGI) score.

From a government perspective, this study is essential to obtain a map of Web 2.0 and social media utilization by government agencies. With knowledge of the government 2.0 utilization map, the Indonesian government can evaluate the effectiveness of its efforts and make its implementation of government 2.0 more comprehensive. From a community perspective, this research can provide information and direction on how to interact with the government by actively using government 2.0 features. This research can enrich the literature regarding the application of government 2.0 in developing countries and the relationship between the application of e-government and the effectiveness of government 2.0.

This paper is divided into six sections. The second section provides a literature review. The third section discusses the research methods for this study, and the fourth section discusses the research results. The fifth section provides a discussion of the effectiveness of government 2.0 implementation, correlation between e-government dan government 2.0, as well as risks and implication of the study. Finally, the sixth section offers a conclusion of this research.

2. Literature review

This section outlines the definition and characteristics of Web 2.0 and government 2.0 and reviews the regulations that support its implementation in Indonesia. It also presents the PEGI, an innovation intended to increase the utilization of e-government in Indonesia.

2.1. Web 2.0 and government 2.0

Web 2.0 provides internet-based online community services for user to create and access content, information, and knowledge [17]. The concept of Web 2.0 is the basis for the development of online social media applications (social software). *Social software* refers to applications that support collaborative behavior, creativity and self-expression, social interaction, and crowdsourcing [18]. It allows for horizontal interaction, without any superiority, inferiority, or control by others, an approach that can facilitate extensive interaction and communication from top to bottom, as well as from the ground up [18]. Several studies have classified social media applications based on their function [5,14,19,20]. Of the various types of social media, Facebook, Twitter, YouTube, blogs, Flickr, and LinkedIn are the most visited social media [14]. Nevertheless, Facebook and Twitter remain the leading social media applications in all aspects of life, including business, government, and personal affairs [21,22].

The role of social media has slowly but surely increased as regards public administration activities. Initially, social media was only used to spread government information to the public. More recently, social media has also become a medium for expressing public complaints and aspirations. Through social media, the government and the community can dialogue with one another. Social media has rapidly become a central component of digital government strategies [5,23]. The adoption of social media in government institutions has led to a new approach in e-government, namely, government 2.0. The concept emphasizes the use of the Internet and social media for information distribution to increase community transparency, participation, and collaboration with governments [24]. Government 2.0 applications have the potential to alter interactions and relationships between the government and society, making them more efficient [1]. Examples of the use of Web 2.0 technologies to facilitate digital government are NASA's internal social networks and virtual worlds, the U.S. intelligence community's Intellipedia, the use of cloud computing services to provide public services by some local government authorities, and the use of Web 2.0 in the UK for intra-organizational operations in local government [2,25,26].

¹ The category of traditional media includes folk songs, dance, music, drama/theater, speeches, literary works, visual products, and shows passed down from generation to generation [30].

² The category of conventional media includes major newspapers, television broadcasting companies, and business magazines [31].

³ The term *new media* refers to media featuring a new platform with high interactivity, including internet media, the digitalization of conventional media, and telecommunications media on mobile devices [32].

2.2. Potential of social media for government institutions

In Indonesia, Ministry of Administrative and Bureaucratic Reform provides guidelines for the utilization of social media by government agencies. This regulation was developed based on the premise that the government must always improve its ability to rapidly face challenges and environmental changes and must function as a bridge to build a conducive atmosphere with the public through a suitable communication process. Furthermore, the government has seen the effectiveness of social media in encouraging communication and interaction with the public, so the government wants to utilize social media to gain public attention and support, instead of relying on conventional media to communicate [10].

The utilization of social media is in line with bureaucratic reform, for example, increased use of information technology (e-government), communication strategy, change management, knowledge management, and the arrangement of business processes). These changes are intended to create transparency, effective and interactive communication, and mutual benefit between government agencies and stakeholders in the implementation of government public relations. They are also essential to gain a shared understanding of social media utilization as a public relations tool in government institutions. The guidelines can also help to promote harmonious and mutually beneficial relationships between government agencies and the media, which will ultimately enhance the government’s reputation.

These guidelines presume several benefits from social media use for government activities. Social media can disseminate government information, development strategies, and goals to society [10]. It can also facilitate interaction between the government and society, resulting in increased public awareness and participation in government policies and programs [10]. Additionally, the government can use social media to explore people’s aspirations, opinions, and inputs on government policies and programs [10]. Generally, social media provides three main benefits: efficiency, ease of service and convenience for users, and community involvement [10].

The characteristics of social media that support potential use by government agencies are participation, openness, conversation, community, and connectedness [27]. Social media encourages the contribution and provision of feedback from everyone interested in a particular topic [27]. It supports openness, as most social media services facilitate feedback from and open participation by each user [27]. These services encourage voting, commenting, and the sharing of information. What is more, there is almost no barrier to users accessing and creating content on social media. If traditional media previously focused on disseminating information, then social media represents a medium for two-way communication. Social media also allows communities to establish communication quickly and effectively [27]. Communities can share the same interests, such as photography, political issues, or television shows [27]. Moreover, almost all social media platforms encourage connections among content, sites, resources, and other individuals [27].

2.3. E-Government Rating in Indonesia

Regulation of the Minister of Communication and Informatics on E-Government Rating in Indonesia states that to increase the efficiency and effectiveness of ICT application in state institutions, the Ministry of Communication and Informatics must periodically issue PEGI scores [28]. The purpose of the rating is to reference the development and utilization of ICT, encourage the increased use of ICT, and obtain an overview of ICT utilization in government institutions nationally [29].

There are five dimensions examined in the PEGI, namely, the policy, institutional, infrastructure, application, and planning dimensions. Each dimension has the same weight in the assessment because all elements are considered necessary, interrelated, and supportive of each other. Each aspect consists of several indicators that are evaluated and weighed

on a scale from 1 (very poor) to 4 (very good).

The policy dimension is closely related to legal products and official documents aimed at directing and encouraging the use of ICT [29]. According to the policy dimension, government institutions need to have a written vision, mission, strategies, standards or guidelines, and regulations relating to ICT use to ensure the continuity of ICT development and utilization programs [29]. Additionally, government institutions need to develop a budget policy on the development and utilization of ICT so that finances are not a constraint from year to year [29].

The institutional dimension is closely related to the existence of an authorized organization responsible for the development and utilization of ICT [29]. Government institutions need a complete structural organization, documents outlining the main tasks and functions, and units and apparatuses to support the use and development of ICT [29]. Furthermore, a legal basis that strengthens the institution’s ability to manage the main tasks and functions is needed [29].

The infrastructure dimension relates to facilities and infrastructure that support the development and utilization of ICT; these consist of computer hardware and software, communication networks (e.g., LAN, WAN, or Internet), service delivery channels (e.g., web, telephone, SMS, or other channels), and supporting facilities (e.g., Air Conditioner, generators, and other security facilities) [29]. The application dimension is related to the use of application software that can, given existing conditions and needs, support efficient work processes and effective service quality; the software must also allow the agency to easily track changes from time to time [29]. The applications must support the general essential functions of the governance system, which are services, administration and management, legalization, finance, and personnel [29].

The last dimension of the PEGI is the planning dimension. This dimension requires government institutions to have a planning process for the development and utilization of ICT, a need assessment, a complete ICT implementation strategy, and a development plan [29].

3. Research methodology

This study adopted Bonsón et al.’s (2012) method to evaluate the implementation of government 2.0. This method can provide a rapid overview of the government’s presence and activities on today’s most widely used social media platforms. This method integrates enough indicators to evaluate social media use in the first phase, utilization of both internal and external channels. The objects observed in this study were websites and social media from 116 government institutions, which consisted of 13 high state institutions, 35 ministry institutions, 28 non-ministerial government agencies, 34 provincial government agencies,

Table 1
Definition of institutions in Indonesia.

High state institutions	A group of major state institutions that form the Indonesian government.
Ministry	An Indonesian government agency in charge of some issues in the government and responsible to the president.
Other government agencies	A state agency that has a ministerial-level position but that is not included in a ministry, including the Attorney General, National Police, Armed Forces, Cabinet Secretariat, Radio Public Broadcasting, and Public Broadcasting Television.
Non-ministerial government institutions	State institutions in Indonesia charged with carrying out specific governmental tasks of the president and responsible directly to the president through coordinating ministers.
Local government	The regional government and regional parliament implement governmental policies based on the autonomy principle. In this study, the local government category focused on the provincial level.

and six other government institutions. The definition of each type of government institution is presented in Table 1. The list of government institutions is based on the list posted on the official website of the Indonesian Parliament (<http://www.dpr.go.id>), Ministry of Administrative Reform and Bureaucratic Reform (<http://www.menpan.go.id/>), and a list of 2014 PEGI participants (<http://PEGI.layanan.go.id>).

[1] used three steps to evaluate government 2.0 implementation. The first step is observation of government agency websites by checking for the presence of eight Web 2.0 features on the sites (Table 2). Each feature is scored with a binary variable (0 if not present, 1 if present).

In the next stage, government activities on social media are measured based on several indicators, including the number of friends or followers, number of dialogues, and number of communities [1]. We collected and analyzed social media data from Twitter, Facebook, and YouTube because these are the three most widely used and visited social media sites by Indonesian people [13]. For this stage, we utilized free social media analytic tools for profile analysis of social media accounts, namely, Twitonomy (www.twitonomy.com) and Topsy (www.topsy.com) for Twitter, and FanPage Karma (www.fanpagekarma.com) for Facebook. After collecting data through observation, we analyzed the data based on the non-exhaustive sophistication index (SI) method presented in Table 3 [1]. The SI method entails assigning a binary value for each item (0 if the item does not exist, 1 if the item exists). There are 12 observed items, eight for official websites and four for external channels (official Twitter accounts, Facebook groups, Facebook pages, and YouTube channels). The SI value for each government agency was calculated in the form of a percentage (the number of items with a value of 1, divided by 12).

The final stage of data analysis entailed parametric statistical tests to identify the effect of e-government implementation, based on the PEGI score, on the effectiveness of government 2.0 in Indonesia (SI score). Since not all government institutions participated in the 2014 PEGI evaluation, the analysis was only carried out on institutions that were involved in the 2014 PEGI evaluation. Thus, 74 government institutions were analyzed in the correlation test. The parametric statistical tests were carried out with SPSS 22.0. The PEGI score was categorized based on five dimensions: policy, institutional, infrastructure, application, and planning. The analysis phase began by calculating the descriptive statistics to obtain the minimum, maximum, and mean values of the PEGI and SI scores. Next, we conducted a Pearson correlation analysis to determine whether there is a relationship between the PEGI scores and SI scores. If a correlation value is not 0, then there is a relationship between the two variables. If the correlation coefficient is positive, then the two variables move in the same direction. Finally, we examined the significance of the relationship between the variables using two-tailed

Table 2
Web 2.0 terminology and definitions [1].

No	Web 2.0 Features	Definition
	Podcast from management RSS/Atom	Audio content
	Vodcast from management	XML format files for the syndication used by most news websites and weblogs
	Real-time webcast of municipality events	Video content
	Widgets	Additional applications for imparting information to visitors and making websites more attractive, such as stock updates, weather forecasts, clocks, calendars, CPU meters, picture puzzles, image slideshows, and so on
	Blogs	Features containing articles displaying information or news to the public, usually equipped with features that allow readers to comment
	Link to official YouTube	Link to official YouTube channel
	Social network profile	Link to Twitter, Facebook, LinkedIn, etc.

Table 3
Items in the sophistication index (adopted from Ref. [1]).

SI	Web 2.0	Official website	Podcast from management RSS/Atom Vodcast from management Real-time webcast of municipality events Widgets Blogs Links to official YouTube Social network
	Social media	External channels	Official Twitter account Official Facebook group Official Facebook page Official YouTube channel

probability values.

4. Results

This section discusses the results of the study, and more specifically, the presence of Web 2.0 features on official government websites, social media usage by government institutions, the effectiveness of Web 2.0 and social media use based on the SI, and the correlation between e-government implementation and use of government 2.0.

4.1. Web 2.0 features on the official websites of government institutions in Indonesia

Table 4 provides a general description of the presence of Web 2.0 features on official websites of government institutions. The table shows that only one government website used eight Web 2.0 features, namely, the Corruption Eradication Commission website (<https://www.kpk.go.id/id>). In contrast, three government institutions only used one feature on their official websites: the provincial-level regional governments in North Maluku, West Papua, and West Kalimantan. The sites of the provincial governments of North Maluku and West Papua contained only widgets and information that was rarely updated by the management. The West Kalimantan provincial government website only contained blog posts with information and public news. Based on the results, 66% of government institutions only utilized two to four Web 2.0 features, and 31% of government agencies displayed five to seven Web 2.0 features on their official websites.

The results on the presence of Web 2.0 features on government agency websites are presented in Table 5.

Based on Table 5, widgets and blogs (98%) were the most popular features and were used by almost all government agencies' websites, except those of two provincial government institutions, namely, North Maluku and West Papua Provinces. Widgets and blogs were the most widely used features by all types of ministry agencies because they are the most common and simple features applied to websites in general. Two other features of Web 2.0 that were widely used by the government agencies to disseminate public information were social networks and vodcasts. Fifty-five percent of the government agency websites provided links to social networking sites and links for visitors to follow ("follow," "like," or "add") the agencies on these social networking sites (Twitter, Facebook, and/or YouTube).

4.2. Social media usage by government institutions in Indonesia

Table 6 contains a general description of social media use by the government institutions: 64% of the government institutions had at least one social media account, and the rest (36%) had no social media accounts at all. Based on Table 6, 22% of the government institutions had Twitter, Facebook, and YouTube accounts; 25% had Twitter and Facebook accounts; 2% had Twitter and YouTube accounts; 9% had a Twitter account, and 6% had a Facebook account.

Based on Table 6, many provincial-level government institutions

Table 4
Use of web 2.0 features on official government websites.

Category of government institution	Number of Web 2.0 features								N
	1	2	3	4	5	6	7	8	
Ministry		8	6	7	9	4	1		35
Other institution		2			3	1			6
High state institution			2	3	4	2	1	1	13
Non-ministry government institution		4	9	9	1	4	1		28
Provincial institution	3	16	6	4	3	2			34
Total percentage (%)	3	30	23	23	20	13	3	1	116
	3%	26%	20%	20%	17%	11%	3%	1%	

Table 5
Use of web 2.0 features by government institutions.

Website evaluation items	Podcast (1)	RSS/Atom (2)	Vodcast from management (3)	Real-time webcast of municipality events (4)	Widgets (5)	Blogs (6)	Link to official YouTube (7)	Social network (8)
Usage (%)	9%	29%	53%	10%	98%	98%	18%	55%

Table 6
Use of social media based on institution type.

	1	2	3	4	5	6	Total number of institutions observed
	Twitter, Facebook, & YouTube	Twitter & Facebook	Twitter & YouTube	Twitter	Facebook	No social media account	
Ministry	9 (26%)	10 (29%)	1 (2.9%)	2 (5.7%)	4 (11%)	9 (26%)	35 (100%)
Other institution	2 (33%)	1 (17%)	-	1 (17%)	-	2 (33%)	6 (100%)
High state institution	5 (38%)	3 (23%)	1 (8%)	1 (8%)	1 (8%)	2 (15%)	13 (100%)
Non-ministry government institution	6 (21%)	10 (36%)	-	3 (11%)	1 (3.6%)	8 (29%)	28 (100%)
Provincial institution	3 (9%)	5 (15%)	-	4 (12%)	1 (3%)	21 (62%)	34 (100%)
Total & percentage for all types of observed institutions	25 22%	29 25%	2 2%	11 9%	7 6%	42 36%	116 100%

(62%) had still not used social media as a medium of communication and interaction. Regarding the popularity of social media in government institutions, this study confirms that Twitter is the most popular social media platform; it was used by 58% of the government institutions at the time of data collection. This finding for Twitter represents the sum of the figures in columns 1, 2, 3, and 4 in Table 6. Facebook was used by 53% of the government institutions (sum of figures in columns 1, 2, and 5), and YouTube was used by 22% of the government institutions (sum of figures in columns 1 and 3).

A further evaluation of the social media activities of the government institutions is summarized in Table 7. Items highlighted in gray indicate the active presence of government institutions, while other items indicate a passive presence. An *active presence* denotes government institutions taking the initiative in creating social media platforms, the number of followers (followers/fans/subscribers), and the institutions' activities on social media. A *passive presence* refers to a community-initiated social media conversation that names the government institution (mention), but is not limited to the official account of a government institution.

Based on Table 7, government agency Twitter accounts had the most followers or fans of any government agency social media accounts (65,000), followed by government agency Facebook pages, which garnered 57,333 fans. In contrast, the average number of YouTube subscribers was still far below the figures for Twitter and Facebook at 214 subscribers. Nonetheless, based on the average number of views (more than 95,000), social media users had widely seen the uploaded YouTube content. Furthermore, high state institutions had more subscribers on Twitter, Facebook, and YouTube than did other government institutions. Therefore, most people preferred to subscribe to government information through Twitter and Facebook.

The active presence of government institutions on social media is

Table 7
Presence and activities of government institutions on social media.

Social media	Type of presence	Social media metrics	Mean
Twitter	Active	Councils with an official Twitter account	67 (58%)
		Average number of Twitter followers	65,000
		Average number of Twitter tweets	4797
	Passive	Average number of Twitter lists	119
		Activity level (most frequent value)	Weekly
		Average number of Twitter conversation in the past 30 days (mention, retweet, tag)	3894
Facebook	Active	Council with an official Facebook group	0 (0%)
		Average number of members of the official Facebook group	0
		Council with an official Facebook page	61 (53%)
	Passive	Average number of fans of the official Facebook page	57,333
		Activity level (most frequent value)	Daily
		Average number of official Facebook groups	0
YouTube	Active	Average number of official Facebook pages	1
		Councils with an official YouTube channel	26 (22%)
	Passive	Average number of subscribers to the official YouTube channel	214
		Average number of YouTube conversations	5353
		Average number of YouTube views ^a	95,586

^a Additional items evaluated by researchers.

reflected in the average number of tweets on Twitter and the level of activity on social media. According to the evaluation results, the average government agency on Twitter had published 4797 tweets. Based on the level of activity indicated in Table 7, most government agencies updated their information via Twitter weekly and via Facebook daily. Although government institutions already had an active presence, most had not yet facilitated two-way communication with the community on social media (followers of government social media). Social media was mostly only used to convey information and one-way news. Nevertheless, some government institutions had individual accounts to facilitate two-way interaction, including the Twitter accounts @BPOM_RI and @HalobPOM1500533, which are managed by the Food and Drug Supervisory Agency (BPOM). The @BPOM_RI account was mostly used to publish information, while the @HaloBPOM1500533 account was a medium for receiving questions, reports, and complaints from users of social media.

The passive presence of government institutions on social media was analyzed by examining the number of mentions addressed to government institutions and initiated by the public on social media. Thus, the passive presence of government institutions on social media can be seen in the number of relevant conversations on Twitter and YouTube, as well as the number of groups on Facebook. The average number of conversations was 3894 for Twitter users and 5353 for YouTube users. During the observation period, there was no Facebook group officially adopted by government institutions. Even so, the average number of public conversations on social media points to interaction and communication between the community and the government.

4.3. Effectiveness of the use of web 2.0 and social media based on the sophistication index

The effectiveness of Web 2.0 and social media use by government institutions was assessed using the non-exhaustive SI. Please see section 3 for the detail of assessment method. Table 8 illustrates how the SI values were calculated.

The evaluation results are presented in Table 9. The percentages represent the effectiveness of government 2.0 applications based on feature types.

Based on Table 9, Web 2.0 and social media, in general, had not been optimally used by government institutions in Indonesia. The scores on using Web 2.0 features and social media are still low, in the range of 9%–58%, except for the use of widgets and blogs. As discussed earlier, the most widely used features by government institutions are widgets and blogs, which are standard features on government institutions' websites. The second most commonly used feature is Twitter. Twitter is popular as a medium for disseminating public information, ensuring that people stay updated, and allowing them to respond to the information shared.

Table 10 presents the SI scores on the use of Web 2.0 and social media by all types of government institutions. The average SI score is 42%, with individual values in the range of 8%–92%. High state institutions had the highest SI score (58%) of all the institution types. The highest individual SI value was also for a high state institution, namely, the KPK (92%), which was confirmed to have applied almost all Web 2.0 and social media features, except for a Facebook group. The lowest average SI value is 29%, for institutions at the provincial level. West Papua Province has the lowest SI value of 8%. The use of Web 2.0 and social media in West Papua Province was minimal, with only widgets available on the official website. The average SI values for ministry agencies, high state institutions, non-ministry government institutions, and other institutions are above average. In contrast, the average SI score at the provincial level is far below the national average. We also analyzed the standard deviations to determine how group values are scattered around the mean values. A low standard deviation means that most results are close to the average, while a high standard deviation means that the results more dispersed. According to our analysis, the lowest standard deviation for SI scores is for the provincial level (0.161), which indicates high homogeneity in use of Web 2.0 and social media

Table 8 Calculation of sophistication index scores.

No	Government institutions (N = 116)	Podcast	RSS/Atom	Vodcast	Real-time webcast	Widgets	Blogs	Link to official YouTube	Social network	Twitter	Facebook group	Facebook page	YouTube	Grand total SI	% SI
1	Majelis Permusyawaratan Rakyat	0	1	1	1	1	1	0	0	0	0	0	0	5	42%
2	Dewan Perwakilan Rakyat	0	0	1	1	1	1	1	1	1	0	1	1	9	75%
3	Badan Pemeriksa Keuangan	0	0	1	0	1	1	0	1	1	0	1	0	6	50%
4	Mahkamah Agung	0	0	1	0	1	1	0	0	0	0	0	3	25%	
5	Mahkamah Konstitusi	0	0	0	1	1	1	1	1	1	0	1	1	8	67%
6	Dewan Perwakilan Daerah	0	1	1	0	1	1	0	1	1	0	1	0	7	58%
7	Komisi Yudisial	0	1	1	1	1	1	1	1	1	0	1	1	10	83%
8	Komisi Pemberantasan Korupsi	1	1	1	1	1	1	1	1	1	0	1	1	11	92%
9	Komisi Pemilihan Umum	0	0	1	0	1	1	0	1	1	0	1	0	6	50%
10	Komisi Pengawasan Persaingan Usaha	0	1	1	0	1	1	1	1	1	0	1	1	9	75%
116	Kementerian Koordinator Kemaritiman	0	0	0	0	1	1	0	0	0	0	1	0	3	25%
	Total score	10	34	61	12	114	114	21	64	67	0	61	26		
	%	9%	29%	53%	10%	98%	98%	18%	55%	58%	0%	53%	22%		

Table 9
Use of web 2.0 and social media by government institutions.

				N	%
				(116)	
SI	Web 2.0	Official website	Podcast from management	10	9%
			RSS/Atom	34	29%
			Vodcast from management	61	53%
			Real-time webcast of municipality events	12	10%
	Social media	External channels	Widgets	114	98%
			Blogs	114	98%
			Link to official YouTube	21	18%
			Social network	64	55%
			Official Twitter account	67	58%
			Official Facebook group	0	0%
			Official Facebook page	61	52%
			Official YouTube channel	26	22%

Table 10
Sophistication index of web 2.0 and social media use by government institutions.

	Min of SI	Max of SI	Mean of SI	Std dev of SI
	8%	92%	42%	0.201
Ministry	17%	75%	45%	0.185
Other institution	25%	92%	58%	0.200
High state institution	17%	75%	49%	0.226
Non-ministry government institution	17%	83%	44%	0.188
Provincial institution	8%	67%	29%	0.161

features. The most heterogeneity was found for high state institutions, with a standard deviation of 0.226.

4.4. Correlation between E-Government implementation and use of government 2.0

The results of a Pearson correlation analysis between the PEGI scores and its dimensions and the SI results are presented in Table 11. The PEGI scores have a positive relationship with the SI scores, with an R-value of 0.452 and a significance level of 0.01 (two-tailed). The highest correlation between the PEGI dimensions and the SI is for the infrastructure dimension, with an R-value of 0.485, followed by the application (R = 0.478), institutional (R = 0.402), planning (R = 0.369), and policy (R = 0.347) dimensions. Because the correlation coefficients are positive, the PEGI dimensions and the SI values move the same direction. In other words, if a PEGI score is high, the SI score is also high. The correlation test also explains the positive interdimensional relationships studied in the PEGI. Table 11 also shows that the significance values of the correlations between the PEGI scores and SI scores are less than 0.005. Thus, the correlations are significant.

5. Discussion

In this section, we discuss the results and answer the research questions, consider the policy implications, and address the risks that accompany the results of this study.

5.1. Effectiveness of government 2.0 implementation

Based on the analysis, the average SI score is 42%, with individual SI values in the range of 8%–92%. The evaluation results show that, in general, the government institutions had used Web 2.0 and social media features, although the adoption level was not even. The correlations between the PEGI scores and SI scores indicate a positive relationship between the effectiveness of e-government implementation and the effectiveness of government 2.0. Thus, government institutions that have properly implemented e-government initiatives have likely also

utilized government 2.0 services effectively.

Based on the results, widgets and blogs were the most popular Web 2.0 features and were widely used by almost all the government agency websites (98%). Widgets and blogs are simple to add to websites. On the websites of government institutions, widgets are often in the form of website visitor information, currency exchange information, weather forecasts, clocks, calendars, image slideshows, and news slideshows. Government institutions also use blog features to display relevant information or news to the public. However, not all blogs on government institution websites allow readers to provide comments or responses to the content provided. These results are different from those of [16]; who found that a complaint feature is the most widely used Web 2.0 feature on Egyptian government agency websites [1]. have reported that the Web 2.0 feature that is most widely used on websites of local government institutions in European countries is RSS/Atom, followed by blogs and links to official YouTube channels [1].

Two other Web 2.0 features that have been widely used by government institutions to disseminate public information are social networks and vodcasts. Most government institution websites have links to social networking sites and links for visitors to follow (“follow,” “like,” or “add”) government pages on these sites (Twitter, Facebook, and/or YouTube). However, there were still several broken links on the websites. Furthermore, vodcasts (video content) have also been widely used to document the activities of government institutions as a form of accountability and transparency of government activities, performance for the public, and promotional media. The RSS/Atom, YouTube, real-time webcast, and podcast features are still less popular and have not been widely applied to government institutions’ websites. Nevertheless, these features may be implemented in the future.

Observations of the social media accounts of government institutions showed that 64% of the institutions had at least one social media account. Twitter was the most popular social media platform and was used by 58% of government institutions, followed by Facebook (53%) and YouTube (22%). This result is consistent with research from Ref. [1], who have stated Twitter is highly popular among local EU government institutions [16]. have confirmed that the most widely used social media platform by government agencies in Egypt is Facebook, followed by Twitter and YouTube [16].

Of the government institutions observed, many provincial-level government institutions (62%) had still not used social media as a medium for communication and interaction with the public. The study also found duplicate government institution accounts on social media (Twitter, Facebook, or YouTube) that could not be verified in terms of authenticity. This is because not all government institutions had included social media account links on their official websites. Most government social media accounts, however, were listed and could be accessed through the official website. Of the unlisted social media accounts, 20% were YouTube accounts, 13% were Facebook accounts, and 10% were Twitter accounts.

Regarding the first research question asking how effective the implementation of government 2.0 in Indonesia has been, these results indicate that government agencies have been effective in utilizing Web 2.0 features and social media. However, the level of adoption has not been even across government agencies.

5.2. Correlation between E-Government and government 2.0

Based the correlations between the PEGI scores and SI scores, there is a positive relationship between the effectiveness of the e-government implementation and the effectiveness of government 2.0 implementation. The highest correlation is for the infrastructure dimension, followed by the application, institutional, planning, and policy dimensions. The relationship between the infrastructure dimension and the effectiveness of government 2.0 shows the importance of communication networks (e.g., LAN, WAN, and internet) in implementing Web 2.0 and social media features as part of government 2.0 initiatives. Notably, the

Table 11
Pearson correlation test results.

		Policy	Institutional	Infrastructure	Application	Planning	Overall PEGI score	SI score
Policy	Pearson correlation	1						
	sig. (two-tailed)							
	N	74						
Institutional	Pearson correlation	.837 ^a	1					
	sig. (two-tailed)	.000						
	N	74	74					
Infrastructure	Pearson correlation	.758 ^a	.853 ^a	1				
	sig. (two-tailed)	.000	.000					
	N	74	74	74				
Application	Pearson correlation	.660 ^a	.809 ^a	.841 ^a	1			
	sig. (two-tailed)	.000	.000	.000				
	N	74	74	74	74			
Planning	Pearson correlation	.855 ^a	.828 ^a	.770 ^a	.707 ^a	1		
	sig. (two-tailed)	.000	.000	.000	.000			
	N	74	74	74	74	74		
Overall PEGI score	Pearson correlation	.907 ^a	.946 ^a	.923 ^a	.868 ^a	.920 ^a	1	
	sig. (two-tailed)	.000	.000	.000	.000	.000		
	N	74	74	74	74	74	74	
SI score	Pearson correlation	.347 ^a	.402 ^a	.485 ^a	.478 ^a	.369 ^a	.452 ^a	1
	sig. (two-tailed)	.002	.000	.000	.000	.001	.000	
	N	74	74	74	74	74	74	74

^a Correlation is significant at the 0.01 level (two-tailed).

existence of internet communication networks is necessary to take advantage of Web 2.0 features and social media.

The second dimension that deserves attention is the application dimension. The relationship between the application dimension and the SI shows the importance of supporting applications for Web 2.0 services and social media as a medium for providing information, facilitating interaction, and offering public services. This is because websites and social media are analogous to the cars used to bring public aspirations to the relevant government institutions.

Furthermore, the relationship between the institutional dimension and the SI shows the importance of the existence of governmental units or apparatuses, a legal basis, and their main tasks and functions for more effectively supporting government 2.0 services. In addition, to increase their effectiveness, government institutions must develop a planning process for the use of government 2.0 services, as well as review their needs and implementation strategies. Equally important is the existence of policies related to the vision and mission that are clearly explained and documented in the form of decrees, regulations, policies, guidelines, strategic plans, or other official documents as directives for implementing government 2.0 services. A vision and mission are essential as guidelines for implementation and success. The five PEGI dimensions need to be considered in relation to the management and monitoring of social media and other government 2.0 services, so as to control the information circulating on government institution social media accounts.

Regarding the second research question on the correlation between e-government management and government 2.0 implementation, there is a significant positive correlation between e-government management (PEGI score) and government 2.0 implementation (SI score). Thus, the higher the PEGI score, the higher the SI score is. In other words, the better the e-government management, the better the implementation of government 2.0 features by government institutions in Indonesia.

5.3. Risks and implications

The use of Web 2.0 services poses a risk to the management of public information. One risk that might arise is related to operational risk. Operational risk is associated with the management and maintenance of social media accounts used by the government. Therefore, the government needs to pay attention to the admins of social media and how they

are responsible for managing accounts and sharing information through social media. There is also a risk of spam, which can be a threat to the government if social media accounts are not correctly managed and monitored. Furthermore, social media use produces an enormous amount of information from the public. Information that is spread through social media cannot always be controlled. All information, both accurate and inaccurate, positive and negative, can spread quickly, encouraging public support or rejection of the government. Under these conditions, social media can be a medium that promotes public participation and involvement or that leads to disputes, chaos, and public slander [21].

Based on this study, not all blogs on government agency websites allow readers to provide comments or responses regarding the information or news. Government agencies can hopefully develop websites with blog features that facilitate interaction between the user community and the government. It is also important for government agencies to post officially managed social media links on their official websites to maintain the credibility and accountability of information and services.

There is still work for the Indonesian government regarding Web 2.0 use. First, the availability of communication networks must be increased, considering that a digital divide still exists. Insufficient regional communication networks are one cause of limited interaction between the government and the public. Second, applications supporting government 2.0 need to be more socialized to both internal governance and the community. The community needs to know how applications can be used and how the applications can help them interact, express their aspirations, and be involved in formulating government policies. Third, the government needs to clarify and spread information about the functions and regulations supporting the implementation of government 2.0. Finally, implementation of government 2.0 not only is related to ICT implementation but also is a new approach to governance. The implementation of ICT without the right changes in leadership, policy, and governance will not result in transparent, active, and participatory governance as envisioned by government 2.0.

6. Conclusion

According to the SI evaluation on the use of Web 2.0 and social media, the average SI score is 42%. The SI score indicates the effectiveness of using Web 2.0 and social media features as a platform for

government 2.0 among government institutions. These results indicate that, in general, government institutions in Indonesia have used Web 2.0 and social media features, although the adoption rate has not been even. The analysis of the use of Web 2.0 features found that widgets and blogs were the most popular features and were used by almost all government institutions' websites (98%). The RSS/Atom, YouTube, real-time web-cast, and podcast features were less popular and had not been widely applied to the websites. Approximately 64% of the observed government institutions had at least one social media account. Twitter was the most popular social media platform and was used by 58% of the government institutions, followed by Facebook (53%) and YouTube (22%).

The correlation analysis found a positive, significant, and moderately strong relationship between PEGI scores and SI scores. In other words, there is a positive link between the effectiveness of the implementation of e-government and the effectiveness of government institutions. Therefore, government institutions that have been effective in implementing e-government have also been effective in implementing government 2.0. The highest correlations between PEGI scores and SI scores were for the infrastructure dimension, followed by the application and institutional dimensions. The results suggest that communication networks (e.g., LAN, WAN, and internet), supporting applications for Web 2.0 services, and the existence of institutions and legal support, can increase the effectiveness of government 2.0 services.

This research has successfully analyzed the use of government 2.0 features by 116 government institutions in a developing country in Southeast Asia. The research contributes to the literature on e-government and government 2.0 by analyzing the correlation between e-government and government 2.0 for the first time, finding a positive and significant correlation between the two variables.

This research has some limitations, which suggest opportunities for further research. This study has only presented a picture of government practices at a certain time. Changes to regulations and developments in internet technology, Web 2.0 tools, and social media could produce divergent results. Future research could also analyze other types of social media, such as Instagram and Line. Finally, this study only evaluated Web 2.0 features and PEGI values, which have been widely publicized but not supplemented with qualitative analyses from government sources. Therefore, qualitative research should complete the analysis of the status quo and further plans regarding the application of government 2.0 in Indonesia.

CRediT authorship contribution statement

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