Measuring the effectiveness of e-government in Malaysia: does information literacy matter?

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Abstract: The objective of this paper is to examine the moderating effect of information literacy between supply-demand factors and the effectiveness of e-government. Particularly, the present study aimed to ascertain whether information literacy moderates the effect of web security, political trust and social influence on the frequency of use and perceived usefulness of government websites in Malaysia. This research employed a quantitative methodology using a survey data amongst 178 adults in Malaysia. Hypotheses were tested through two levels of ordinary least squares regression models. The results showed that social influence is positively related with both frequencies of use and perceived usefulness. However, web security was associated only with the former whilst political trust was associated only with the latter. Lastly, we found a weak relationship between information literacy and the frequency of use. Overall, this paper tested on a comprehensive model of supply-demand factors on a broader perspective of e-government effectiveness amongst users.

Keywords: e-government; information literacy; web security; political trust; social influence; Malaysia.

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1 Introduction

The era of digitalisation has impacted the landscape of today's world tremendously. Most importantly, it refines not only how profit-oriented entities like businesses operate but also how governments deliver services to people. Electronic government, or e-government, is briefly defined as the application of technology in public service deliverance, particularly web-based systems, for various purposes such as providing information, conducting transactions and making decisions (Wirtz et al., 2015). The implementation of e-government generally aims to increase accountability and efficiency in government-stakeholder interactions. Thus, scholars generally agree that the effectiveness of e-government is equally crucial like in other settings such as business-to-customer websites.

Following the suit, research on e-government has advanced mostly on the identification of key determinants to the effectiveness (Seel and Thomas, 2007; Yang and Rho, 2007). However, studies remain fragmented in examining either the supply side factors such as easy of navigation and web privacy (Wirtz et al., 2015), or the demand side factors such as awareness of public services and trust (Mensah and Adams, 2020). Although these studies have contributed much to the literature, there is still lack of understanding on the effects within a specific economic-social issue, that is information literacy.

Information literacy can be understood as a possession of knowledge and skills for utilising technologies in hand (Hall and Owens, 2011). Whilst most studies assume that users of e-government are homogenous in term of their capability to seek and exploit online information, in reality, a factual data by the Organization for Economic Co-operation and Development (OECD, 2001) shows that information gap is still apparent across demographics; men versus women, young versus old, rich versus poor, and rural versus urban residents.

Synthesising these lines of issue, this study embarks to examine the moderating effects of information literacy between supply-demand factors and the effectiveness of e-government services. The comprehensive review on existing research identifies three important factors of supply which are:

1 web security and demand

2 political trust

3 social influence.

To advance, we captured two stages of effectiveness: frequency of use and perceived usefulness, as endogenous variable. Further, we drew on technology acceptance model (TAM) and social cognitive theory (SCT) to develop and test hypotheses using a survey data amongst 178 adults in Malaysia.

This study contributes foremost to shed light on important yet mostly neglected issue of information gap in measuring the effectiveness of e-government. This issue is even promising when it is discussed in the context of developing countries like Malaysia (Okunola et al., 2017). Second, our model tests on an integrated supply and demand factors whilst capturing a multi-level effectiveness: frequency of use and perceived usefulness. Thus, this research offers a comprehensive evaluation of e-government from various theoretical and practical lenses.

2 Literature review

2.1 Underpinning theories on e-government effectiveness

Alike many other affairs, public service also could not escape the need for digitalisation. Prior research has offered few definitions for e-government, whereas in short, it refers to a transformation of existing government services into a digital mostly web-based platform (Wirtz et al., 2015). Thus, e-government could range from the simplest web page of displaying information to the most complex transactions such as pay taxes or even online voting. Most importantly, e-government should make governments function more efficient (Dwivedi et al., 2017) and advantageous for all parties including businesses, citizens and the government itself (Means et al., 2000).

However, the provision of e-government must uphold the key principles in e-democracy: upward control, political equality and social norm. For that, scholars highlight that e-government should be able to provide unlimited access to information, improve government – stakeholder-interactions, and foster accountability (Wirtz et al., 2015). For example, Janssen et al. (2018) mention that e-government can serve as a means to build trustworthy institutions, hence establishes strong confidence towards the government. As a result, the satisfaction of users on e-government is far more impactful than other applications such as e-commerce websites because it is closely connected to overall citizen's participation in government administration (Holzer et al., 2004).

Existing literature provides two dominant theories for measuring the effectiveness of e-government: TAM and SCT. TAM originally stems from information systems field that extends into the understanding of why individuals embrace or reject new technologies (Davis et al., 1989). In general, TAM proposes that the perceived ease of use increases the perception of a person using a particular technology, thus it would enhance his/her job performance (Davis et al., 1989). Accordingly, many empirical works have drawn on TAM to explain associated behaviours such as perceived usefulness and perceived ease of use (Pavlou, 2003) in various technological contexts including e-government (Wirtz et al., 2015). However, TAM assumes all users as a homogenous group and neglects the heterogeneity in demographic factors. To compensate, we integrate SCT that is able to capture personal factors in evaluating the effectiveness of e-government.

SCT that is firstly introduced in psychological studies, proposes that human behaviour is determined by both personal factors and the surrounding environment (Bandura and Cervone, 1986). Applying SCT in technological research, prior research

argues that the level of technology acceptance is resulted from both the technical conditions of the system and the socioeconomic circumstances of the users (Thatcher and Ndabeni, 2011). Similarly, SCT is also appropriate to delineate personal-social issues such as the information gap across nations (Dwivedi et al., 2017).

In summary, TAM and SCT serve as underpinning theories in this study to describe how e-government features (web security) interact with personal factors (political trust and social influence) for influencing the frequency of use and perceived usefulness of e-government amongst users.

3 Hypotheses

3.1 Web security and e-government effectiveness

Security is inarguably the main concern for users when using a digital platform for any purpose. In brief, online security deals with the actions taken by the web authorities to safeguard activities from intrusions or attacks by unauthorised parties (Sicari et al., 2015). Even in e-government applications, citizens are very conscious with the web security particularly involving personal data disclosure or financial transactions (Beldad et al., 2011). Related security breaches in government websites such as information leaks, financial losses, or malicious attacks bring a great harm not only that disappoints users but contributes to overall dissatisfaction towards the government.

At international level, many countries especially in developed economies have invested a lot in order to improve the web security through both physical infrastructure and law empowerment. For example, in the UK, adequate measures have been taken with the adoption on related policies such the UK's Privacy and Electronic Communications Regulations 2003, the UK's Information Assurance Framework, and the Trust Services e-Government Strategy Framework Policy and Guidelines. The aim is not only to offer safety protection in online activities but more importantly to earn general confidence from the public. Bélanger and Carter (2008) argue that citizens often reluctant to use e-government when there is lack of trust in security, mostly in countries with weak legislative institutions. Unfortunately, strong initiatives to increase security still barely exist in developing countries like Malaysia (Ambali, 2009), which have reduced the acceptance rate on government e-services.

Following this argument, we posit that favourable perception on the web security will increase the frequency of use amongst citizens and subsequently shapes a positive opinion about the usefulness of e-government services (Alsmadi and Abu-Shanab, 2016).

Hypothesis 1 Web security is positively related with

a frequency of use

b perceived usefulness of e-government.

3.2 Political trust and e-government effectiveness

The implication of e-government acceptance is far more significant than other applications such as e-commerce because it reflects a perception of users not only towards e-public services but also a general trust on the government as an institution.

Classical understanding refers trust as the extent of beliefs in the noble intentions and actions of someone (Cook and Wall, 1980). More comprehensively, trust is defined as a confidence that the trusted parties will not act anything harmful, rather will act accordingly that is beneficial, reasonable and suitable to the trusting parties (Paliszkiewicz, 2011). From a psychological perspective, trust is a mental state which involves interpersonal relationship that is voluntary but situational rather than global (Paliszkiewicz, 2011).

Deriving from that, political trust can be understood as a form of trust that describes the citizens' confidence in government in order to legitimise the political institution in a country (Turper and Aarts, 2017). The legitimation shapes a confidence that the public affair will deliver good services including the parliament, the civil service and the political parties (Wang, 2005).

Applying the understanding into the context of e-government acceptance, people with a strong trust believe that the current government has worked sufficiently by all means to satisfy general expectations and demands (Miller and Listhaug, 1990). Trusting citizens respect the government decisions as wise and beneficial for all, in contrast to distrusting citizens (Rudolph, 2009). As the results, they are more likely to use e-government portals and perceive those as useful.

On the other hand, citizens with lack of trust in politics have unfavourable attitudes towards policies setup by the institutions (Stolle et al., 2005). Consequently, government can become ineffective especially when decisions made on crucial matters receive low support from the public (Rose et al., 2018). Similarly, the initiative of the government to digitalise public services will be less acceptable among distrusting people.

Hypothesis 2 Political trust is positively related with

a frequency of use

b perceived usefulness of e-government.

3.3 Social influence and e-government effectiveness

The effect of social influence is originated from a traditional view that people naturally think they should behave a specific way (Fishbein and Ajzen, 1975). In other words, social influence exists when a person makes any decision in life by taking into consideration the opinions of the close circle especially family and friends (Venkatesh et al., 2012). In fact, in a modern world, the circle can be extended into the power of the media, public views or referents like experts or elders (Oni et al., 2017).

Accordingly, Ng and Rahim (2005) posit that the views of family, friends, peers and colleagues are very influential in determining whether or not someone uses a specific technology application. In the same vein, the adoption of e-government is resulted from the social advice received by the user (Razak et al., 2017).

Hypothesis 3 Social influence is positively related with

a frequency of use

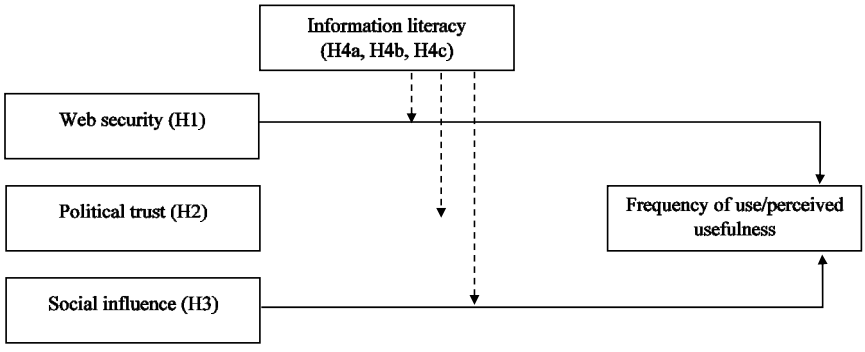
b perceived usefulness of e-government.

3.4 Information literacy as a moderator

Whilst web security constitutes the supply factor, and political trust and social influence represent the demand factors; this research further argues that the effects on e-government adoption is contingent upon the information literacy of the user.

The original idea of information literacy was introduced by Zurkowski (1974) to describe an individual's capacity to mould information in order to meet personal needs. People from various demographics and socio-economics: gender, age, education level, and living area, have different levels of access to internet technology thus it determines their capability to exploit informative resources (Okunola et al., 2017). Therefore, information literacy is a practical solution to a digital divide that remains prevalence all over the world. In contrast, information illiterate refers to those who do not possess the skills, knowledge and capabilities to utilise technologies as a source of information for reaching particular personal and professional goals (Hall and Owens, 2011; Yu et al., 2017).

Figure 1 The model of the study



In the context of e-government acceptance, the effects of demand-supply factors are expected to be strengthened for users with strong information literacy. Although ones consider e-government as secured and have a strong political trust and social influence; they would use e-government less often and perceive it less useful due to inability to fully capitalise the information available on the websites.

Hypothesis 4a Information literacy positively moderates the effect of web security on

a frequency of use

b perceived usefulness of e-government.

Hypothesis 4b Information literacy positively moderates the effect of political trust on

a frequency of use

b perceived usefulness of e-government.

Hypothesis 4c Information literacy positively moderates the effect of social influence on

a frequency of use

b perceived usefulness of e-government.

The model of this research is shown in Figure 1.

4 Data

This research employs data from a National Public Survey 2020 (NPS) which is intended to serve as a nationally representative sample of Malaysian adults. NPS data is the most recent and comprehensive dataset carried out among adults in all states nationwide. The main objective of NPS is to acquire general information on demographics and various aspects of adult's behaviour in the country. For the purpose of this research, we analysed NPS data amongst 178 randomly selected adults.

Table 1 shows the descriptive analysis of the respondents. 73% of the respondents were women whilst the average age of all respondents was 37 years old. Also, almost half of the respondents held bachelor's degrees or equivalent and a quarter of the respondents had a master's or doctoral degree. Besides, over 84% were currently employed with half of the respondents were from a middle-class income. Lastly, almost 90% of the respondents lived in urban areas, an information gathered to shed light on information literacy issue.

Table 1 Descriptive analysis of the respondents

Variable	*Description*	*Measurement*
Gender	0 = 73%	0 = woman, 1 = man
	1 = 27%	
Age	Mean = 37.12	Continuous
	SD = 9.66	
	Minimum = 18	
	Maximum = 64	
Education level	1 = 9.0%	1 = secondary school or lower
	2 = 15.7%	2 = diploma or equivalent
	3 = 49.4%	3 = bachelor degree or equivalent
	4 = 25.8%	4 = master degree and above
Employment status	0 = 15.7%	0 = not employed, 1 = employed
	1 = 84.3%	
Economic class	1 = 34.3%	1 = bottom 40
	2 = 51.1%	2 = middle 40
	3 = 14.6%	3 = top 20
Residence	0 = 12.9%	0 = rural
	1 = 87.1%	1 = urban

Table 2 Correlational table

Variable		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
1	Gender	1.000											
2	Age	0.066	1.000										
3	Education level	–0.249	0.244	1.000									
4	Employment status	–0.155	0.093	0.032	1.000								
5	Economic class	–0.086	0.415	0.346	0.218	1.000							
6	Residence	–0.030	0.022	0.118	0.202	0.087	1.000						
7	Web security	–0.008	–0.200	–0.088	0.041	0.068	–0.089	1.000					
8	Political trust	0.035	–0.199	–0.194	–0.072	0.000	–0.175	0.701	1.000				
9	Social influence	0.046	–0.056	–0.154	–0.005	0.052	–0.092	0.551	0.591	1.000			
10	Information literacy	0.012	–0.039	0.231	0.095	0.201	0.040	0.116	0.387	0.246	1.000		
11	Frequency of use	0.052	–0.007	–0.065	0.053	0.129	–0.179	0.429	0.535	0.561	0.313	1.000	
12	Perceived usefulness	0.034	–0.059	–0.087	–0.015	0.071	–0.124	0.706	0.619	0.649	0.207	0.546	1.000

The bivariate correlations between all variables are shown in Table 2. There are few important takeaways learned from the table. Most importantly, information literacy was found stronger amongst people with better education level and higher economic status. However, younger people seemed to have a lower trust in politics and perceived e-government as less secured. Instead, political trust was higher amongst adults with lower education level and lived in rural area.

4.1 Variables

The dependent variable of frequency of is captured from a single question "how often do you use the internet for browsing government websites?" measured on a five-point Likert scale ranging from 1 (never) to 5 (always), whilst perceived usefulness is a total score of two questions in a five-point Likert scale from 1 (totally disagree) to 5 (totally agree) "I feel that seeking information on government websites helps me a lot", and "I would recommend others to visit government websites to seek information."

All explanatory variables are measured in two questions. Web security measures if "government websites assure the confidentiality of my personal information" and "government websites never misuse my personal information" (Cronbach's alpha = 0.923). Political trust asks, "I have trust on the government today" and "I believe the government today would do the best they could for the citizen" (Cronbach's alpha = 0.955). Social influence captures on "people who are important to me think I should use government websites" and "people whom the opinion I value most recommend me to use government websites" (Cronbach's alpha = 0.965). Lastly, the moderator of information literacy inquiries "I know how to find helpful resources on the internet" and "I have the skills needed to make use the resources I found on the Internet" (Cronbach's alpha = 0.881). All of these questions were also measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Lastly, we included demographic controls in our estimation: gender, age, education level, employment status, economic class and residential area.

5 Results

This study employed a two-stage ordinary least square (OLS) regression to estimate our models. First, we examined the effects of independent variables on the frequency of use government websites, shown in Table 3. Second, we tested the impact on the perceived usefulness of government websites by inserting the frequency of use as additional control, shown in Table 4. For both estimations, we included the controls in model 1, then tested only the direct effects of all independent variables in model 2, before examining the full model together with the interaction terms for each independent variable in models 3, 4, and 5 subsequently.

In Table 3, the low significant level in model 1 suggests that our demographic controls did not explain much on the frequency of use government websites. However, all models consistently showed that adults living in rural areas browsed government websites more often than those living in urban cities. Models 2 through 5 supported the Hypotheses 1a and 3a that perceived security and social influence are positively related with the frequency of use government websites. However, political trust was insignificant

and did not predict the e-government use; rejecting Hypothesis 2a. Lastly, although we found a moderate positive relationship between information literacy and the frequency of use; no significant moderating effects had emerged from our models, rejecting all of Hypothesis 4a.

In Table 4, we retained all variables and newly introduced the frequency of use as a control. We argued that the frequency of e-government is very likely to influence the subsequent perceived usefulness of the websites. It is indeed verified in all models that the frequency of use is strongly related with the perceived usefulness in a positive way, whilst all other controls are insignificant.

Table 3 OLS regression of the frequency of use government websites

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Gender	0.190 (0.252)		0.126 (0.204)	0.119 (0.205)	0.113 (0.205)
Age	–0.011 (0.012)		0.008 (0.010)	0.008 (0.010)	0.007 (0.010)
Education level	–0.128 (0.135)		–0.009 (0.117)	–0.024 (0.117)	–0.037 (0.118)
Employment status	0.271 (0.308)		0.187 (0.250)	0.199 (0.250)	0.202 (0.250)
Economic class	0.416* (0.185)		0.117 (0.152)	0.128 (0.152)	0.128 (0.152)
Residence	–0.846** (0.325)		–0.6000* (0.264)	–0.593* (0.265)	–0.589* (0.264)
Web security (WS)		0.176** (0.051)	0.149** (0.056)	0.143* (0.056)	0.141* (0.056)
Political trust (PT)		0.003 (0.040)	0.011 (0.042)	0.012 (0.043)	0.016 (0.042)
Social influence (SI)		0.211*** (0.043)	0.192*** (0.043)	0.195*** (0.043)	0.197*** (0.045)
Information literacy (IL)			0.104$^{\gamma}$ (0.053)	0.096$^{\gamma}$ (0.054)	0.091$^{\gamma}$ (0.053)
WS × IL			0.013 (0.013)		
PT × IL				0.005 (0.013)	
SI × IL					–0.002 (0.016)
Constant	4.955*** (0.591)	0.554 (0.392)	–0.440 (0.796)	–0.271 (0.780)	–0.204 (0.776)
Adjusted R^2	0.040	0.367	0.383	0.380	0.380
F value	2.232*	35.197***	11.000***	10.864***	10.845***

Notes: ***p < 0.001, **p < 0.01, *p < 0.05, $^{\gamma}$p < 0.10 (two-tailed).

However, the effect of independent variables is slightly different from Table 3. Whilst social influence remains essential in explaining the perceived usefulness (supporting Hypothesis 3b), perceived security is surprisingly shown no effect (rejecting

Hypothesis 2b). Instead, Hypothesis 2b verified that political trust is positively related with the perceived usefulness of government websites. Lastly, Hypothesis 4b receive no support that we yielded a non-significant effect of information literacy as well as the interaction terms.

Table 4 OLS regression of the perceived usefulness of government websites

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Gender	–0.035 (0.368)		0.005 (0.274)	–0.012 (0.268)	0.013 (0.276)
Age	–0.015 (0.018)		0.011 (0.014)	0.011 (0.014)	0.013 (0.014)
Education level	–0.152 (0.198)		0.087 (0.157)	0.037 (0.154)	0.109 (0.159)
Employment status	–0.303 (0.450)		0.054 (0.336)	0.056 (0.328)	0.026 (0.338)
Economic class	0.205 (0.273)		–0.014 (0.204)	–0.039 (0.199)	–0.036 (0.205)
Residence	–0.113 (0.482)		0.114 (0.360)	0.131 (0.351)	0.073 (0.361)
Frequency of use	0.896*** (0.111)		0.293** (0.104)	0.289** (0.102)	0.278** (0.105)
Web security (WS)		0.101 (0.068)	0.031 (0.077)	0.035 (0.074)	0.047 (0.076)
Political trust (PT)		0.344*** (0.054)	0.372*** (0.056)	0.404*** (0.056)	0.362*** (0.056)
Social influence (SI)		0.324*** (0.058)	0.270*** (0.062)	0.270*** (0.060)	0.282*** (0.064)
Information literacy (IL)			–0.027 (0.073)	–0.051 (0.071)	–0.012 (0.072)
WS × IL			–0.032$^{\gamma}$ (0.18)		
PT × IL				–0.058** (0.017)	
SI × IL					–0.023 (0.22)
Constant	7.100*** (1.002)	2.371*** (0.527)	1.613 (1.070)	1.691$^{\gamma}$ (1.020)	1.243 (1.046)
Adjusted R2	0.278	0.594	0.606	0.624	0.601
F value	10.718***	87.344***	23.640***	25.428***	23.175***

Notes: ***p < 0.001, **p < 0.01, *p < 0.05, $^{\gamma}$p < 0.10 (two-tailed).

6 Discussion and conclusions

Acknowledging the need to digitalise public services, governments in most countries are progressively adopting e-government in the administration. However, in reality, not all

citizens prefer to use or consider e-government applications beneficial for resolving their matters. More importantly, does information gap contribute to further tangle this issue?

To advance our understanding on what really drives individuals to use e-government effectively, this research attempted to examine the relationship between – supply (web security) demand (political trust and social influence) on two types of e-government endogenous: frequency of use and perceived usefulness. Further, we were also interested on the moderating effect of information literacy on the links. Drawing on TAM and SCT, we developed and tested hypotheses using the NPS data of 386 students in Malaysia.

Our analysis on two models: frequency of use and perceived usefulness, yielded slightly different results. For the former, web security and social influence were found influential; whilst political trust and social influence were significant to the latter. However, there was no apparent evidence that information literacy affects the two or moderates the relationships.

From the findings, it is supported that people use e-government and continuously do so if they consider the sites are secured from potential risks, whether or not they trust the government. Instead, political trust contributes to improve the perceived usefulness of government websites. Also, social influence is extremely vital in pushing individuals into using and constructing evaluation on the e-government. These findings fit with the natural behaviour of human being that is greatly influenced by external environments/opinions (Fishbein and Ajzen, 1975). Lastly, we argued that perceived usefulness could also be improved as the users browse government websites more often. It is common for technology-naïve users to get confused when navigating websites for the first time but should gradually familiarise after some time.

This research also provides several practical implications. Foremost, it suggests that government should improve the web security in order to attract more people to browse e-government sites. In other words, users would neglect to use e-government if they thought that public websites are prone to related risks such as data breach or misuse of personal information. Second, government should also propagate the political ideologies for developing trust amongst the citizens which deems essential in cultivating perceived usefulness of e-government. Lastly, from our controls, we would recommend that e-government use and perceived usefulness are not explained by gender, age, economic status, or even the information literacy. Implicitly, it shows that e-government in Malaysia is not left behind people of specific gender, generation or economic class; hence, a good prospect to grow further in the future.

7 Limitation and future research

Despite its contributions, this research is not without caveats. Mostly importantly, we did not comprehensively control for all possible confounding variables. Obviously, there are other factors found important in determining the usage of web applications such as ease of use (Xia et al., 2018) and prior experience (Akyüz, 2013). Second, since the research was conducted in a single country, our analyses could not insert country-level variables in the model such as digital infrastructure or digital regulations in the country (Oxley and Yeung, 2001). Lastly, although this study attempted to adopt a two-level analysis, the empirical execution is too simplistic as we merely inserted the frequency of use as additional control.

For future research, we hope that these limitations could be rectified particularly on the empirical approach by having more controls to test a complete model of e-government predictors. Also, the generalisation of the findings could be strengthened using more comprehensive data across countries. Lastly, the two-stage of behaviour; frequency of use and perceived usefulness, should capture more robust theoretical discussions and empirical analyses.

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