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A Cross - Country Study on E - Government Interoperability Capability and E-Government Services

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Abstract

Nowadays, e-Government is increasingly playing an important role in the development strategy of countries around the world, paying special attention to the field of E-Services. Countries' governments have invested a lot of money in developing e-Government, but the results have not been as effective as expected. The online service index (OSI) has differences between countries and territories. The main reason for this situation is that when developing e-Government development strategies, countries do not consider both technical factors and political, social and environmental factors. Limitations of literature are studies that are mostly focused on a specific country or countries but focus on only a few specific factors. The question is how and how the E-Government Interoperability capability can affect E-Service provision in different countries and territories around the world. Therefore, this paper will use Technology - Organization - Environment (TOE) method combined with secondary data source from the World Economic Forum's International Data Technology Report (WEF).
After data analysis and evaluation, the final result reflects the growth of e-Government interoperability maturity (ICT Infrastructure, Human Capital, Electronic Participation) and ICT Legal environment have affect to e-service provision. Based on different characteristics and different compatibility, each country has a different online service development model. Finally, the contribution analysis, limitation and several recommendations are given, in order to help policy makers, Government Leaders and citizens understand the importance of the E-Government Interoperability capability, e-Services and thereby outline the specific roadmap and development strategy suitable for each country.

Keywords: Information system, E-Government information system, Interoperability, e-Government, TOE, E-Services.

INTRODUCTION

There are many definitions and concepts of e-services, but a standard definition and used in this study scope is: Electronic service is a very general term, often referring to provisioning. Services via the internet, so e-services may also include e-commerce, although it may also include non-commercial services (online), which are often provided by the Government. (Irma Buntantan & G. David Garson, 2004; Muhammad Rais & Nazariah, 2003). Many benefits when countries adopt and develop e-government services such as providing people and businesses with public services enabling people to access everywhere easily, Reduce costs for the government apparatus, Implementing a modern, efficient and transparent government. Therefore, in recent years, governments of countries around the world have tried and endeavored to develop infrastructure, finance, and resources to improve and upgrade their electronic public service system.

However, there are still many difficulties and challenges in the process of developing e-government in countries around the world (Azad, B., & Zablith, F. (2018). The first is that the online service index is still low compared to the investment levels of governments and countries (UNDESA, 2014). Secondly, the level of effectiveness of the mechanism and policies between different countries is uneven (Abrahams, L. (2009). Thirdly, while online public services have increased in quantity, the quality of services provided to people remains low, especially in developing countries (E-Government report, 2015). The main reason for this situation is that when developing e-Government development strategies, countries do not consider both technical factors and political, social and environmental factors.

Assumed the experiments mentioned on top of, the issues are outstretched regarding what Interoperability capability would possibly effect the difference in e-service clause between countries. Moreover, this subject has been of attention to researchers

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recently (Kovacic (2005), Moghadam & Assar (2008), Zhao (2011), Khalil (2011), Cabinakova et al. (2013), Al-Hujran et al. (2011), Lee et al. (2013), Zhao et al. (2014), Nguyen, N. A. (2016)). Most of the literature focused on a specific country or countries but focus on only a few specific factors. So that paper goal to bring a lot of complete examination on Interoperability capability and e-service delivery on the international scale by victimization different secondary knowledge sources with strong knowledge analysis strategies.

The implication of this research will help policy makers, Government Leaders and citizens understand the importance of the E-Government Interoperability capability, e-Services and thereby outline the specific roadmap and development strategy suitable for each country.

The next sections of this paper are systematized as follow: the second section is concerning theoretical background and literature review. Then the third section presents the analysis framework as well as analysis model, methodology and hypotheses. Next, section four will show the data analysis and findings. Lastly, the contribution and limitation of the research will be discussed in the last section.

LITERATURE REVIEW

Since e-Government services delivery jointly of the highest priorities within the national agenda, governments worldwide have allotted resources into online applications growth.

Nevertheless, despite big resource investments, the adoption rate of e-government Interoperability initiatives over the planet is much from expectations.

In previous studies, the relationship among different factors such as country-specific factors, national wide factors, and information system Interoperability adoption level as well as E-Government Services provision has been widely acknowledged. Grönlund's (2004) thoroughgoing review of a hundred and seventy papers reveals the range of e-government research in content further as ways. Abundant e-government and Interoperability analysis have been qualitative, consisting of elaborated case studies of triple-crown e-government comes, valued to persons who assume similar creativities. For example, Devadoss, Pan and Huang (2002) analyze the growth of a government e-procurement application employing a model supported structuration theory and develop a classification of things concerned in e-government initiatives. Moreover, Ke and Wei [2004] trace the event of one ministry's e-government efforts to focus on; however, the critical success factor evolved because the ministry went through totally different stages of reform.

Similarly, Golden, Hughes, and Scott (2003) follow a people government's "evolutionary path" in e-government, and exploitation the lens of business method transformation, list learning points for different governments.

Such descriptive studies, however, don't try to assess the comparative success of the various government in understanding the potential of e-government Interoperability. To it finishes, an alternate series of research comes, a lot of quantitative focussed has developed and used numerous criteria to live the performance of governments. These vary from technical indicators (such because the variety of Internet connections in a very country, or whether or not the utilization of digital signatures is established or not) to usage measures (such as however typically residents interact with their governments over the web, or the quantity of hits on government net sites). Some studies conjointly assess however intensively Internet technology is employed in a very government's internal operations, by observing aspects like the percentage of state internet sites that provide a minimum of one on-line service to voters (West 2000), the benefit of accomplishing a typical task on-line (by investigation the quantity of departments that need to be visited or the quantity of forms to be submitted), or the satisfaction of tourists to a government internet site (Steyaert 2004).

Regarding on Singh, H., Das, A., & Joseph, D. (2007); (West 2005), these studies focus on the e-government's Interoperability maturity in a specific country, described it as the extent to that a government has established the online presences. Cross-country comparisons of e-government are typically undertaken by tripartite organizations or consulting companies.

There is a minimum of three reasons why their work is efficacious. First, few lecturers have the worldwide multi-country footprint that such studies need. In distinction, international organizations such as tripartite bodies and consulting companies have offices in most countries and might collect data with relative ease. Second, these international benchmarking reports are updated frequently (usually annually), making valuable historical information sets. Finally, e-government Interoperability being associate degree applied the field of analysis, new ideas originate in fields of observing as typically as they are doing in the domain. An example is Accenture's now-famous "publish-interact-transact" framework to explain the progress of e-government Interoperability portal. Flowing out of the variable emphases of the various kinds of studies are the divergent performance measures crafted to assess "successful" e-government Interoperability.

Existing educational literature on e-government Interoperability is predicated on surveys and case studies, coverage several innovative practices, however conjointly some large-scale project disappointments in developed as well as developing countries and areas (Lee, Tan, & Trimi, 2005).

However, a lot of the present e-government Interoperability analysis focuses on developed countries, Although a comparatively little variety of studies explored developing e-government Interoperability capability development, they did therefore in a single country perspective (Abusin, 2007; Ciborra and Navarra, 2005; AL-Shehry, Rogerson, Fairweather & Prior, 2006;). Accordingly, very little is understood concerning the present state of developing e-government Interoperability capability developments. Relating to on study of Chatfield, A. T., & Alhujran, O. (2009), the most important aim of this study, is to provide associate insight into e-government Interoperability capability development stages of e-government service delivery among many developing countries. During this article, they conjointly compare these developing countries to the worldwide top six e-governments Interoperability capability in developed countries, notably concerning e-democracy, the highest level advanced e-government service and Interoperability capability known within the literature.

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Another study about technological factors which affect to E-Government Information System Interoperability. In this study, Van Thanh, N. et al., 2018 mentioned different technological factors affect to Interoperability in E-Government Information System in the case of Vietnam. Risk Management, Collaboration, and Coordination, Technical Expertise influence the adoption of Interoperability.

In summary, most of earlier researches found within the literature either utilized primary information within which the results were forced to a particular case study, or utilized secondary information source that could be disapproved for lacking informative power because of omitting necessary factors.

Related to literature about influence effect of the Interoperability capability and others discriminal to E-Government Services provision among different countries in the world, Nguyen, N. A. (2016) by using secondary data from different resources, they proposes that ICT legislation framework, management optimization process, government IT leadership, and national culture have effects to the e-service delivery.

The widest used dataset for activity e-government Interoperability capability is that the United Nations e-Government Survey series. Though the international organization survey has been thought-about as a good tool for benchmarking and comparison e-Government Interoperability capability development standing among countries, it used a compound live of e-Government Interoperability capability that draws on solely three sub-indices (human capability index, telecommunication infrastructure index, and on-line service index) that can inadequate to explain the character of e-Government Interoperability capability. There also are alternative factors that may have influenced to e-Government Interoperability capability development. By relevance existing studies' contribution and limitation, this analysis aims to counterpoint the literature review by captivating into thought the consequences technical and non-technical factor similarly because of the no uniformity among countries. Technological - Organizational - Environmental framework Tornatzky and Fleischer presented their TOE model within the book "The Processes of Technological Innovation" (1990).

Moreover, the model describes three dimensions consisting of varied factors that are posited to effect an organization's innovation adoptions and implementation method. These three are the organizational context; the technological context and therefore the environmental context. In particular, the technological context mentions to each the inner and external technologies related to the organization.

Moreover, this contains standing technologies that are implementing within the firm (internal), also as those are offered within the trade (external). Hence, the organizational context is outlined in term of firm's characteristic and resource as well as a social control structure, organization size, internal communication method, human capitals and therefore the number of loose resources. In another side, the environmental context shows the house within that the firm works its business the existing infrastructure, the trade structure, competitors, the legal framework, and therefore the availableness of suppliers. Generally, these three teams demonstrate "both constraints and opportunities for technological innovation" (Tornatzky & Fleischer, 1990).

Moreover, there has been a considerable body of studies within the literature that used TOE framework to discover and authenticate the result of various factors to Interoperability adoption, and therefore the model has incontestable a good descriptive ability across varied analysis domains and scopes. Attainable factors influencing information system Interoperability capability adoption were unconcealed through a variety of examinations showed at firm levels (Zhu et al. (2004), S. H. Teo et al. (2006); Kuan & Chau (2001),).

Within the perspective of e-government Interoperability capability, an analog development happens where varied technological, structure and environment determinant was found as motivating services or blocks to the e-government Interoperability capability development standing (Srivastava & S. H. Teo, 2006), and e-government assimilation (Pudjianto et al., 2011), and e-government adoption rate of public sector organizations (Ebrahim et al., 2004), and m-government readiness (Mtingwi & Belle, 2013). However, these studies, targeted solely on one situation which created the result are unable to widespread. This analysis can attempt to fill during this gap by spreading the empirical analysis to a wider logic wherever TOE model was applied across a wider variety of states.

Research Model and Hypotheses

Research goal: To determine the impacts of E-Government Interoperability maturity on Eservice provision.

Research question: What are the impact factors of Interoperability capability to E-services provision among countries?

• Variables definition:

ES= E-Services provision.

ITI= Information Technology Infrastructure

HC = Human Capital

EP= Electronic Participation

ITLE= ICT Legal Environment

ITL= IT Leadership

MO= Management Optimization

= the random-effect error

= random error term

=β1+β2 +β3 + β3 + β4 + β5 + β6 +

Generalized least squares and Hausman-Taylor estimator to test the relationship between ES and E-Government Interoperability maturity

Used software :

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STATA SE 12

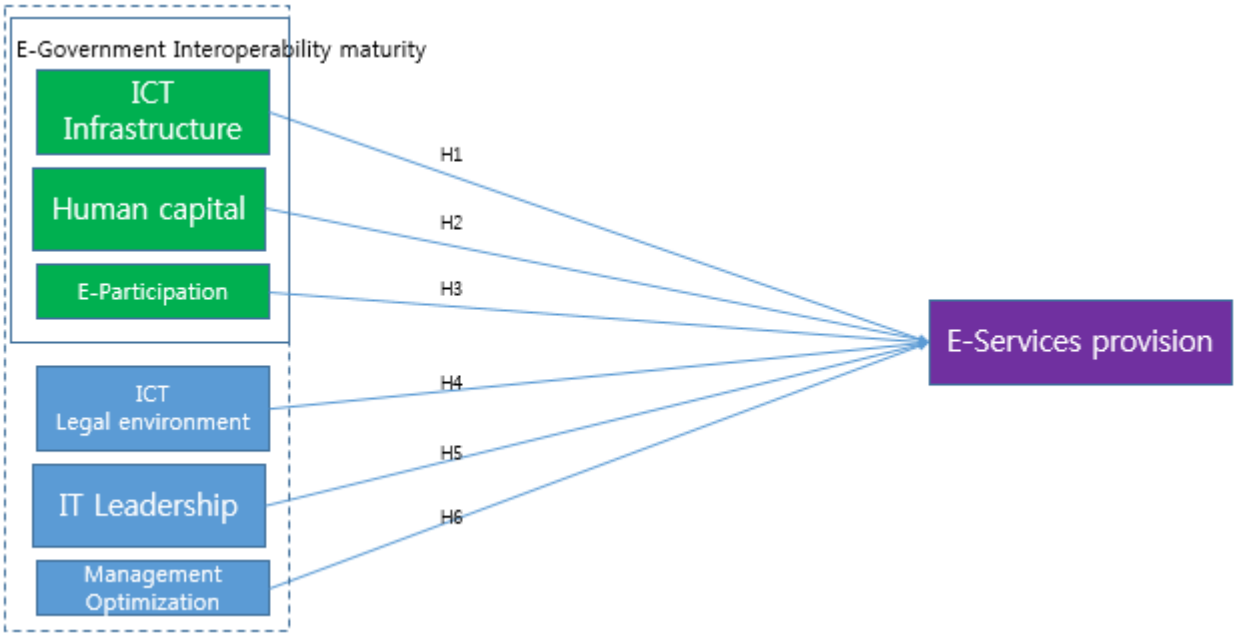

Figure 1: Research Model

Hypothesis:

In the perspective of e-Government services, ICT infrastructure, includes: bandwidth capacity, Internet connectivity, secure servers, computers, hardware, software, network devices, and so on have a high priority to consider (Srivastava & S. H. Teo, 2006). Hence, I hypothesize that:

Hypothesis 1: ICT infrastructure has significant positive influence to the e-service provision.

Human capital which is measured by Human Capital index affects the growth of E-Government Services as well as E- Portal services (Gottwald, D., Švadlenka, L., & Pavlisová, H. (2016)). Hence, I hypothesize that:

Hypothesis 2: Human capital has significant positive influence to the e-service provision.

E-Participation or citizen participation has a strong relationship and engagement with E-Government Services in effective Information Technology design and delivery (Olphert, W., & Damodaran, L. (2007)). Hence, I hypothesize that:

Hypothesis 3: E-Participation has significant positive influence to the e-service provision.

High level of ICT legal environment will effect to online electronic government services by making robust regulation environment (UNDESA, 2014). Hence, I hypothesize that:

Hypothesis 4: ICT legal environment has significant positive influence to the e-service provision.

In E-Government perspective, IT Leadership or IT champion is the strong motivation from public organization side to enhance the development of E-Services (Mtingwi & Belle (2013), Zahril Shahida Ahmad (2015)). Hence, I hypothesize that:

Hypothesis 5: IT Leadership has significant positive influence to the e-service provision.

Similar to IT Leadership, Management optimization in the meaning of collaboration and coordination from government public organizations, has important role in pushing the development of E-Government Services delivery (S. H. Teo et al. (2006)). Hence, I hypothesize that:

Hypothesis 6: Management optimization has positive significant influence to the e-service provision.

RESEARCH METHODOLOGY

Data

To validate all hypotheses, this research used secondary data from the official source: the World Economic Forum (WEF)'s Global Information Technology Report. A total of 151 countries considered in the above data source during the period 2012 - 2016 were included.

Measurements

E-service is the dependent variable taken from the Government Online Services Index indicator of World Economic Forum (WEF)'s Network Readiness Index historical dataset. This indicator estimates the maturity level of five online service

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applications: e-health, e-tax, e-custom, one-stop shop, and e-procurement. Different levels of e-service delivery are static website, no plan found; no online presence; one-way interaction; two-way interaction; and online transaction enabled.

The ICT infrastructure is the independent variable taken from the Infrastructure and Digital Content pillar of WPF's Network Readiness Index. This index arrests the development of ICT infrastructure (counting the international Internet bandwidth, mobile network coverage, electricity production, and secure Internet servers,) and the accessibility of digital contents (World Economic Forum, 2016).

Human Capital is taken from the Skills pillar of WPF's Network Readiness Index. In particularly, the skills pillar (four variables) measures the ability of a society to make effective use of ICTs thanks to the presence of basic skills taken by the quality of the education systems, , and the rate of secondary education enrollment, and the level of adult literacy.

E-Participation is the independent variable taken from the E-Participation indicator of World Economic Forum (WEF)'s Network Readiness Index historical dataset. This indicator includes the E-Participation Index assess, on a 0-to-1 (best) scale, the relevance, quality; and usefulness of government website in offering online information and participating tool and services to the citizens.

Management optimization is the independent variable is taken from the World Economic Forum (WEF)'s Network Readiness Index historical dataset. Management optimization mentions the activities approved out by government so that to increase government organizations' internal processes (World Economic Forum, 2016). This index reproduces the efforts of the grade of information systems integration, strategy planning, and cross-agency collaboration, and business process reengineering.

IT Leadership is the independent variable is taken from the World Economic Forum (WEF)'s Network Readiness Index historical dataset. This index is estimated based on the attendance of GCIO mandate, government chief information officer (GCIO), and CIO organization and CIO development programs.

ICT legal environment is the independent variable is a pillar directly booked from the Political and Regulatory Environment pillar of WEF's Network Readiness Index. Moreover, this index reproduces - the extent to that the national lawful framework enables ICT diffusion and safe growth of business activity, captivating into account general structures of the regulation situation and more ICT-specific dimensions (World Economic Forum, 2016).

Data analysis

To analysis empirically, this study applied Fixed-effect analysis, Hausman test, and Generalized Least Squares regression to find out the possible special effects of both time-invariant and time-variant factor to the level of e-service delivery in a country. Generalized Least Squares regression is desirable in this work because this methodology overcomes the limitations of random-effects and Fixed-effect analysis. The descriptive analysis of data from 2012-2016 is displayed in Step 1.

Step 1: Descriptive analysis

Table 1. Descriptive analysis

Variable	Observation	Mean	Standard deviation	Min	Max
E-Services	702 702	0.4466202	0.2257612	0	1
Data availability	702	4.126354	1.517432	1.020212	7
Data accessibility	702	4.544803	1.12827	1.827858	6.534676
Re-useable data	702	0.3495352	0.2653664	0	1
ICT legal environment	702	3.861986	0.8838896	2.169411	5.973649
Management optimization	702	4.128419	0.8369408	1.913612	6.141844
IT Leadership	702	4.003541	0.8675272	1.819178	6.28593

Step 2: Calculate Correlation parameter

Table 2. Correlation calculation

Correlation	Data availability	Data accessibility	Re-useable data	ICT legal environment	Management optimization	IT Leadership
Data availability	1.0000					
Data accessibility	0.8392	1.0000				
Re-useable data	0.6014	0.5185	1.0000			
ICT legal environment	0.7320	0.6367	0.5415	1.0000		
Management optimization	0.1366	0.1569	0.1537	0.0335	1.0000	
IT Leadership	0.1763	0.1759	0.1761	0.1106	0.9130	1.0000

Step 3: Fix- effect analysis

Table 3. Fix- effect analysis

E-Services	Coefficient	Standard Error	t	P> |t|	[95% Conf. Interval]

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Data availability	0.0125486	0.0136818	0.92	0.359	-0.0143298	0.0394269
Data accessibility	-0.0094496	0.0279113	-0.34	0.735	-0.0642823	0.0453831
Re-useable data	0.3223191	0.0231121	13.95	0.000	0.2769145	0.3677236
ICT legal environment	-0.087381	0.0209167	-4.18	0.000	-0.1284727	-0.0462893
Management optimization	-0.0167531	0.0144533	-1.16	0.247	-0.0451471	0.0116409
IT Leadership	0.0178736	0.013548	1.32	0.188	-0.0087419	0.0444892

Step 4: Random effect analysis

Table 4. Random effect analysis

E-Services	Coefficient	Standard Error	z	P> |z|	[95% Conf. Interval]	
Data availability	0.0125486	0.0136818	0.92	0.359	-0.0143298	0.0394269
Data accessibility	-0.0094496	0.0279113	-0.34	0.735	-0.0642823	0.0453831
Re-useable data	0.3223191	0.0231121	13.95	0.000	0.2769145	0.3677236
ICT legal environment	-0.087381	0.0209167	-4.18	0.000	-0.1284727	-0.0462893
Management optimization	-0.0167531	0.0144533	-1.16	0.247	-0.0451471	0.0116409
IT Leadership	0.0178736	0.013548	1.32	0.188	-0.0087419	0.0444892
Sigma_u	0.04277203					
Sigma_e	0.8666635					
rho	0.19586168 (fraction of variance due to u_i)					

Step 5: Hausman test

Table 5. Hausman test

	-------Coefficients---------			
	(b) fem	(B) rem	(b-B) Difference	Sqrt (diag (V_b-V_B)) S.E.
Data availability	0.0125486	0.0136818	-0.0354753	0.0116922
Data accessibility	-0.0094496	0.0279113	-0.0337273	0.026455
Re-useable data	0.3223191	0.0231121	-0.0980746	0.0191536
ICT legal environment	-0.087381	0.0209167	-0.1468307	0.0103662
Management optimization	-0.0167531	0.0144533	0.0055668	0.0063432
IT Leadership	0.0178736	0.013548	-0.002303	0.0053289

b= consistent under Ho and Ha; obtained from xtreg

B= inconsistent under Ha; efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

Chi2 (6) = (b – B) ‘ [(V_b-V_B) ^ (-1)] (b – B) = 279.24

Prob>chi2 = 0.0000

Step 6: Autocorrelation analysis

Wooldridge test for autocorrelation in panel data

H0: no first-order autocorrelation

F(1, 141) = 1585.887

Prob > F = 0.0000

Table 6. Autocorrelation analysis

Step 7: Heteroskedasticity analysis

Modified Wald test for groupwise heteroskedasticity in fixed effect regression model

H0: sigma (i) ^ 2 = sigma^2 for all i

Chi2 (148) = 8.5e + 32

Prob>chi2 = 0.0000

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Table 7. Heteroskedasticity analysis

Step 8: Generalized Least Squares regression (GLS)

Cross-sectional time-series FGLS regression
Coefficients: generalized least squares
Panels: homoskedastic
Correlation: no autocorrelation

Estimated covariances = 1
Estimated autocorrelation = 0
Estimated coefficients = 4
Log likehood = 563.8744

Table 8. Generalized Least Squares regression

E-Services	Coefficient	Standard Error	z	P> |z|	[95% Conf. Interval]	
Data availability	0.039881	0.0059169	6.74	0.000	0.0282842	0.0514779
Data accessibility	0.015536	0.0068257	2.28	0.023	0.0021578	0.0289142
Re-useable data	0.5423515	0.0193423	28.04	0.000	0.5044413	0.5802616
ICT legal environment	0.0203884	0.0069999	2.91	0.004	0.0066689	0.0341079
Management optimization	-0.0210367	0.0122408	-1.72	0.086	-0.0450283	0.0029548
IT Leadership	0.0190898	0.0118204	1.61	0.106	-0.0040779	0.0422574

RESULTS AND DISCUSSION

In common, the result suggests that E-Government Interoperability maturity (ICT Infrastructure, Human capital, E-Participation) and ICT legislation environment have influenced on the growth of online service provision. This result is consistent with previous studies in this research area.

Table 9. Summary of results

	Hypothesis	**Result**
H1	ICT infrastructure has positive significant influence to the e-service provision.	Supported
H2	Human capital has positive significant influence to the e-service provision.	Supported
H3	E-Participant has positive significant influence to the e-service provision.	Supported
H4	ICT legal environment has positive significant influence to the e-service provision.	Supported
H5	IT leadership has positive significant influence to the e-service provision.	Not Supported
H6	Management Optimization has positive significant influence to the e-service provision.	Not Supported

From the results, we can see:

ICT Infrastructure has a positive effect on E-Services provision. The government needs to invest more and more into ICT infrastructure to enhance the delivery of E-Government services and bring efficiency.

Human capital has a positive weak significant effect on E-Services provision. The government should promote education skills and level of people, at the same time combine with another factor to develop and upgrade E-Government services delivery.

E-Participation has a most positive significant effect on E-Services provision. Encouraging the participation of the citizen is the keystone of socially comprehensive governance. Moreover, the purpose of e-participation creativities should be to expand the citizen's access to information and public service and encourage participation in public decision making that influences the well-being of society, generally, and the personal, in detail.

Contributions

The contributions of this study are about theoretical and practical.

In term of Theoretical contribution, this research attempts to investigate the influence of interoperability maturity factors to E-government services delivery through using T-O-E theory. Moreover, this study combined three factors (ICT infrastructure, Human capital, E-Participation) to see how E-government Interoperability maturity affect to E-Services provision is a new point in this study model.

In term of Practical contribution, the results help policy maker to comprehend the weaknesses and strengths of the country’s current standing of e-government development, so to supply correct changes.

CONCLUSION AND FUTURE WORK

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In this study, in the perspective of analysis on e-government Interoperability capability for development, an idea of the worldwide digital divide is often usefully applied to estimate e-government Interoperability capability development stages beside the prevailing economic division within the world. Moreover, this analysis bestowed insights into the present landscape of e-government Interoperability capability developments within the different countries from side to side a cross-country comparative analysis of their e-government service delivery capabilities.

This analysis marks vital contributions to the prevailing e-government Interoperability literature. Firstly, evidence found within the study increases our awareness of a large digital divide that exists even among the developing countries and developed studied. Secondly, the inequality within the delivery of advanced e-government service provision capabilities even among the comparatively homogenized economic group suggests the vital importance of knowledge and competence based resources, for they are critically necessary for effective and economical use of latest ICTs used by e-governments Interoperability, and for the property development of the new digital economy notably in developing countries. Lastly, this analysis varies from the previous e-government Interoperability studies that mostly targeted on developed countries or specific e-government in a single country perspective. By implementing a cross-country comparative analysis strategy, this analysis has provided new insights into the worldwide digital divide within the perspective of e-government Interoperability for development.

Moreover, our analysis limitations embrace that our results characterize a static, photograph read of the present scenery of the Interoperability capability and e-government service delivery over and done with a cross-country comparative analysis conducted at one specific purpose in time. Within the dynamically changing e-government Interoperability development atmosphere, such a static read provided several limitations to our analysis and understanding. Nevertheless, in light-weight of a transparent lack of analysis on e-government Interoperability development stages within different countries, our analysis approach may be even at this exploratory stage. Any analysis is needed to handle this limitation by a longitudinal cross-country analysis over an extended amount of the time, and to assess changes in e-government Interoperability development.

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