

High-Level Factors Affecting Global Availability of Online Government Services

Kathleen M. Boyer-Wright, Jeffrey E. Kottemann
Salisbury University

kmwright@salisbury.edu, jekottemann@salisbury.edu

Abstract

The purpose of this research is to develop and test a parsimonious theory of the drivers of global level e-government. Specifically, we compare individual and business usage of online government services both as direct antecedents and as indirect factors mediated by government development of an ICT regulatory environment. Using 2006 data from the World Economic Forum's (WEF) Government Information Technology Report (GITR), we develop and test our theory using data on 122 countries. Our findings indicate that business rather than individual usage of e-government services has greater explanatory value as an antecedent to the availability of those services, and that the ICT legal environment mediates both relationships.

1. Introduction

“After e-commerce, get ready for e-government.”
Matthew Symonds, *The Economist*, June 22, 2000 [1]

As new information and communications technologies (ICT) become available, national and local governments are increasingly using them to solve public management problems. Individual citizens and businesses are also applying pressure to governments to use ICT as a means of increasing transparency and improving accountability [2,3]. The resulting expansion in “e-government” — here defined as the support and stimulation of good governance practices via electronic means — has been mirrored by a corresponding growth in e-government research. For example, HICSS initiated an e-government track in 2001, which has now grown to accommodate 9 mini-tracks. Articles on e-government practices and approaches now appear routinely in information systems and public policy journals, including a recently created online journal focusing solely on e-government research and there is a European conference solely devoted to e-government topics.

Despite this growth in research interest, Heeks and Bailur [4] critically analyze journal and conference publications relating to e-government and find a serious lack of formal theory development and testing. Their analysis of eighty-four articles across three journals from 2002-2005 found that the preponderance demonstrated a lack of theory, clarity about assumptions and methodologies, or rigor in the collection and analysis of data. The majority of the studies were characterized as “optimistic” applications of e-commerce theories with little benchmarked data or quantitative empirical evidence to support recommendations. They also suggest that much of the research on e-government focuses on technology in isolation without assessing environmental factors or the vast differences in government resources globally.

As one possible approach to rectifying these problems, Heeks [5] recommends use of official statistics such as those compiled by the United Nations, the World Bank and the World Economic Forum as valuable sources for examining linkages between e-government and other institutional factors. Not only is the data immediately available, it is highly comparable across nation economies.

The purpose of the present research, then, is to develop and test a parsimonious theory of the drivers of e-government development. Specifically, we associate individual internet access and business usage to online government services both as direct antecedents and as indirect factors mediated by government development of an ICT regulatory environment. Using 2006 data from the World Economic Forum's (WEF) Government Information Technology Report [7] made available online through INSEAD (available from: <http://www.insead.edu/gitr/main/home.cfm>), we develop and test our theory using data on 122 countries.

The research motivation is really two-fold. We intend to provide and test an interesting theory of the wide-ranging, high-level dynamics associated with e-government; it is also to show the value that sources such as WEF possess for e-government research. Our

findings indicate that business rather than individual usage of e-government services is more strongly associated with the availability of those services across global economies. The ICT legal environment was also found to be an important mediating factor, suggesting that governments should consider policies regarding privacy, digital signatures and the like as they roll out e-government services.

2. Hypothesis Development

It has been widely noted that governments tend to be reactive rather than proactive in their initiatives. For example, Themistocleous, et al. [8] point out that the government sector introduces Information and Communications Technology (ICT) reactively, unlike the private sector. Kamal [9] echoes this and postulates that external forces/pressures as well as policy and legal frameworks may [be needed to] positively impact ICT adoption in government organizations. These points are critical because they imply that third-party forces may play a key role in motivating governments to develop e-government services, to continually augment services, and to enhance the availability of and access to these services.

In this study we propose that e-government development is driven by demand for government online services that arises when individuals and businesses increasingly utilize internet-based ICT functionality. Therefore, rather than assuming a “pull” model, we theorize that individual and business internet use is antecedent to the development of e-government online services. And because the types of government services provided to individuals (e.g. individual tax payments, passports, parking violations, etc.) vary considerably from the interaction of government and businesses (corporate tax payments, e-procurement processes and the like) we hypothesize that individual and business internet usage are individually and positively associated with the availability of online services. Finally, as shown in Figure 1 below, we anticipate that the relationships are additive.

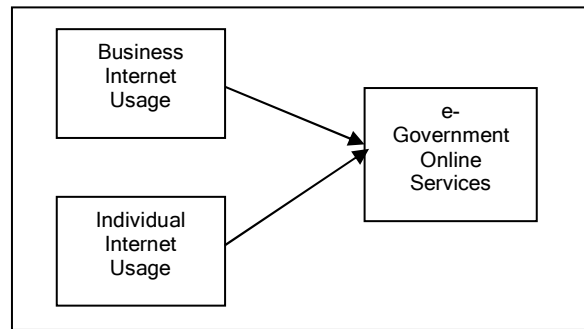


Figure 1: Business/individual internet usage as antecedents to e-government online services

These relationships can be restated as the following three hypotheses:

H₁: The extent of business internet usage is positively associated with availability of e-government online services.

H₂: The extent of individual internet usage is positively associated with availability of e-government online services.

H₃: The association of individual and business internet usage to the availability of e-government online services is additive.

E-government, however, is more than just a government website on the Internet. It has as its strategic objective the support and simplification of processes relating to governance issues [3] implying a supporting ICT legal environment that addresses such issues as digital signatures, consumer protection and privacy. Therefore, we posit the development and enforcement of laws relating to the ICT milieu as a third key factor:

H₄: The development and enforcement of an ICT legal environment is positively associated with availability of e-government online services.

Recent theoretical work on the evolution of e-government [2] suggests that as governments increase online public services in response to demands from individuals and business, the corresponding ICT legal environment also increases in complexity and sophistication. Therefore, we hypothesize that the development and enforcement of ICT rules and standards mediates the direct relationship between individual/business Internet usage and the availability

of e-government online services. The mediation model is depicted in Figure 2 and can be restated as the following two hypotheses:

H₅: *The development and enforcement of an ICT legal environment mediates the association of business Internet usage and availability of e-government online services.*

H₆: *The development and enforcement of an ICT legal environment mediates the association of individual Internet usage and availability of e-government online services.*

The full model, showing the mediating effect of the ICT legal environment is depicted in Figure 2, below:

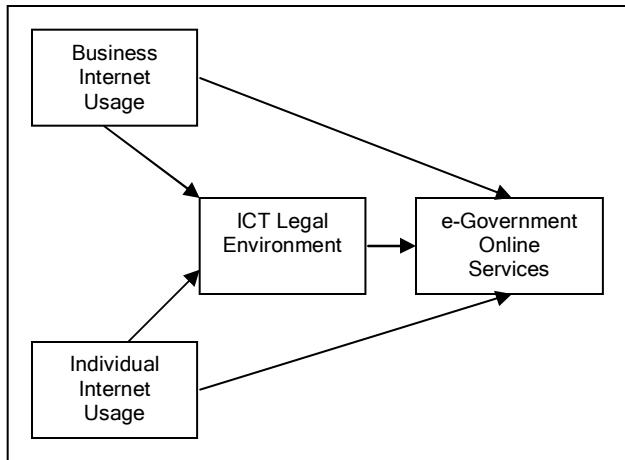


Figure 2: Mediation model

3. Data and Methods

3.1 Variable Selection

All of the variables used in this analysis are operationalized using data available in the WEF 2006-2007 Government Information Technology Report (GITR) [7]. This secondary data source is developed by INSEAD to support Network Readiness Index rankings for 122 economies. It includes 60 measures culled from a variety of sources, covering individual, business and governmental factors relating to information technology. Three of the four variables discussed below were drawn from an Executive Opinion Survey dataset of 11,000 total responses conducted as part of the GITR data collection process.

The value for each of the 122 nation economies represents the mean value for that country.

We assigned the dependent variable the name **GOS** for Government Online Services and selected the measure, Availability of Online Services supported by the Executive Opinion Survey item:

“In your country, online government services such as personal tax, car registrations, passport applications, business permits and e-procurement are (1=not available, 7=extensively available).”

Note that the listed services include items that apply to individuals as well as to business users; therefore, this variable should capture the perceptions of individual citizens as well as corporate users.

As stated previously, we hypothesize that two key factors affect perceptions of GOS: the Proportion of Internet Users (**PIU**) and the extent of Business Internet Use (**BIU**). The former is operationalized as the number of individual Internet users per 100 inhabitants and the latter by the Executive Opinion Survey item

“In your country, companies use the Internet extensively for buying/selling goods and services and for interaction with customers (1 = strongly disagree, 7 = strongly agree).”

The final factor, Laws Relating to ICT (**LAW**), is operationalized by the Executive Opinion Survey item:

“Laws relating to the use of information and communication technologies (ICT) (electronic commerce, digital signatures, consumer protection) are (1=nonexistent, 7=well-developed and enforced).”

Again, note that the examples of ICT laws address concerns that potentially apply to both individual and corporate users.

A summary of the four variables and their descriptive statistics are shown in Table 1:

Table 1: Variable Descriptive Statistics

Variable	Min.	Max.	Mean	Std. Dev.
GOS	1.53	6.45	3.63	1.24
BIU	1.94	6.14	3.90	.97
PIU	.21	87.76	23.05	22.37
LAW	1.47	5.73	3.73	1.08

3.2 Analysis

As the sample size (N=122) was too small to analyze the relationships in a single model, we relied on regression analysis to test individual associations. All statistical tests were performed using a resampling with replacement (bootstrapping) technique with 1000 iterations to obtain confidence intervals at the 2.5% and 97.5% levels. Rather than use generic distribution tables to compute approximate probability values, resampling generates a unique sampling distribution based on the actual data at hand and uses experimental rather than analytic methods. Unlike approximation with generic distribution tables, resampling yields unbiased estimates because it is based on unbiased samples of all possible outcomes in the data being sampled [10].

For tests of mediation, we used a resampling approach developed by MacKinnon, et al [11] to test for the attenuating affect of the mediating variable. Again, 1000 iterations were performed. The beta coefficient of the mediated variable was subtracted from the coefficient of the same variable in unmediated single regression in each iteration. If the difference is positive in 950 iterations, it is possible to conclude that the mediating variable attenuates (partially mediates) the relationship between the antecedent independent variable and the dependent variable at the $\alpha=0.05$ level.

4. Results

Following hypotheses one and two, single regression analyses using resampling with replacement were performed on BIU→GOS and PIU→GOS respectively (Table 2). Note that both relationships were highly significant ($p<.001$). Business usage is positively associated with the availability of government online services. This supports hypothesis one. Similarly, an increase in the proportion (per 100) of individual users, PIU, is positively associated with an increase in the availability of government online services supporting hypothesis two.

Table 2: Regression analyses, hypotheses 1 through 4

Relationship	>		<	
	2.5%	97.5%	Mean	Sig.
H ₁ : BIU→GOS	.982	1.20	1.09	p<.001
H ₂ : PIU→GOS	.033	.046	0.04	p<.001
H ₃ : BIU+PIU→GOS	.793	1.22	1.01	p<.001
BIU→GOS	-.004	0.01	0.00	p<.401
PIU→GOS				
H ₄ : LAW→GOS	.920	1.10	1.01	p<.001

Note that for hypothesis three in which both BIU and PIU are added in the model, the association of BIU and GOS retains its value in terms of overall significance and beta coefficient value; however, PIU→GOS is no longer significant. Thus, hypothesis three is not supported. Additionally, the results suggest that the association between PIU and GOS may possibly be mediated by BIU.

Hypothesis four assesses the association between the ICT legal environment (LAW) and availability of online government services. Similar to BIU, the relationship is approximately a one-to-one correspondence (i.e. an increase by one in the evaluation of the ICT legal environment is associated with a commensurate increase in the perceived availability of e-government service) and is highly significant.

Recall that hypotheses five and six relate to the potential mediation of business usage and individual usage by the ICT legal environment. Prior to testing these hypotheses, bootstrapped regression analyses were performed to test the associations of BIU and PIU with LAW. In both cases, the relationships were found to be highly significant. (Table 3).

Table 3: Preliminary regression analyses, hypotheses 5 and 6

Relationship	>		<	
	2.5%	97.5%	Mean	Sig.
BIU→LAW	.91	1.07	0.99	p<.001
PIU→LAW	.04	.044	0.04	p<.001
H ₅ : BIU→LAW →GOS	BIU→GOS is attenuated, but not fully mediated.			p<.001
H ₆ : PIU→LAW →GOS	PIU→GOS is attenuated, and driven to zero			p<.001

As discussed previously, subsequent resampling tests were conducted to determine if the introduction of LAW between BIU and GOS would attenuate the primary relationship. As shown above, in each of the 1000 iterations for BIU→LAW→GOS, the coefficient of the relationship between BIU→GOS was significantly reduced, but not driven to zero, by the introduction of LAW. This result suggests that the ICT legal environment is an influential explanatory factor in the relationship between the extent of business internet usage within a country and the availability of e-government services.

With respect to PIU→LAW→GOS, the ICT legal environment completely attenuated the relationship between individual internet usage and availability of e-government services. Therefore, it appears that the relationship between individual internet users and the availability of e-government online services within countries can be explained largely by the extent of the supporting ICT legal framework.

Thus both hypotheses five and six are supported; however the mediating role of the ICT legal environment varies dependent on whether the antecedent variable is business or individual internet usage. A summary of the results follows in Table 4.

Table 4: Summary of Findings

Hypothesis	Supported?
H ₁ : BIU→GOS	Yes
H ₂ : PIU→GOS	Yes
H ₃ : BIU+PIU→GOS	No
H ₄ : LAW→GOS	Yes
H ₅ : BIU→LAW→GOS	Yes, partial mediation
H ₆ : PIU→LAW→GOS	Yes, full mediation

5. Discussion and Conclusions

What can we glean from this data and analysis? The research here indicates that high-level factors of individuals, businesses, legal environments, and governments exist in a dynamic interplay – and that these high-level factors interact directly and indirectly in the ongoing process of e-government development.

Two important considerations emerge. First, business internet usage appears to be a more robust explanatory antecedent of the development of e-government services than individual usage. This makes intuitive sense in that individual use of government services in general tend to be more sporadic and ad hoc than government-to-business

interaction. If this is the case, it may be difficult to benchmark e-government effectiveness on the basis of e-government to citizen interaction.

The second consideration is that the ICT legal environment is a mediating factor in the relationship between both individual and business internet users and e-government. In other words, it is not sufficient to simply focus on the technical provision of e-government services; legal protections and regulatory implications must be considered as well. The WEF measure used in this study is broadly focused; country data on specific business regulatory practices (available from the World Bank – Financial and Private Sector Development: <http://rru.worldbank.org>) could shed additional light on those aspects of the regulatory environment that are the most beneficial.

It is important to point out the limitations of this research. As previously discussed, the measures used in this research are broad indicators. Nevertheless, they are high in comparability and therefore, very useful in painting a global picture. In addition to the WEF data used in this analysis, the United Nations and World Bank sites also conduct ongoing data collection on a number of variables that may potentially be relevant to e-government research. While they should not be considered a sole source of information on this issue, they certainly provide a broad perspective that can serve as a starting point for additional detailed analysis. The fact that e-government is, by design, internet-based provides creative opportunities for obtaining specific benchmark data, such as web metrics and hyperlink analysis [6].

Finally, we have been very careful to avoid drawing any causal inferences in this analysis. As this study uses cross-sectional data, it is risky to draw cause-and-effect conclusions. Future longitudinal research is needed to clarify the issues raised here as well as to explore the wide range of issues related to the interplay of the actors and stakeholders in e-government. Fortunately, it appears that several of the useful secondary data sources mentioned here have some prior data available and will be continuing to publish data in future years enabling future research to evaluate the role and progress of e-governments across multiple stages.

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