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E-GOVERNMENT, E-BUSINESS, AND NATIONAL ENVIRONMENTAL PERFORMANCE

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Abstract

What is the relative importance of the contextual factors facilitating e-government and e-business development in a nation? What is the relationship between e-government and e-business in a nation? What is the relationship of e-government and e-business development in a nation with its environmental performance? These are the three research questions that we intend to address in this study. Specifically, by utilizing the Technology-Organization-Environment (TOE) theory and the Resource-Based-View (RBV) of a firm as guiding lenses, this study identifies the relative importance of TOE contextual factors (i.e., ICT infrastructure, human capital, and institutions) facilitating e-government and e-business development. Further, grounding the discussion in information technology (IT) impact literature, we investigate the impact of e-government and e-business development on national environmental performance. By addressing the intersection of these two global trends (i.e., growing requirements for public- and private-sector organizations in a country to use the Internet for conducting their businesses and operations, and increasing demands for them to engage in national-level environmental sustainability practices), findings from this study is expected to contribute to the theoretical discourse on RBV and IT impact by identifying the relative importance of TOE contextual factors on e-government and e-business development in a country, and provide indications to practice on enhancing its environmental performance through effectively managing those factors and increasing the levels of e-government and e-business development.

Keywords: *E-government, e-business, environmental performance, RBV, TOE, IT impact.*

1 INTRODUCTION

Sustainability refers to meeting the needs of present generations without compromising the ability of future generations to meet their needs (Brundtland 1987). This definition is related to triple-bottom-line (TBL), a broad conceptualization of organizational and national performance (or sustainability) encompassing economic, environmental, and social dimensions (Porter and Kramer 2006). While the economic dimension relates to issues concerning profit, the environmental and the social dimensions pertain to issues relevant to planet and people respectively (Elkington 1998). In this paper, of the three dimensions, we focus on environmental dimension of TBL. According to the world commission report on environment and development (Brundtland 1987), an environmentally sustainable system must maintain a stable resource base, avoiding over exploitation of renewable resource systems or environmental sink functions, and depleting non-renewable resources only to the extent that investment is made in adequate substitutes. Information Technology (IT) has significant importance in causing and managing issues pertaining to environmental sustainability, and hence, for IT, environmental sustainability objectives represent a double-edged sword.

Existing studies on environmental sustainability incorporating information systems (IS) perspectives can be broadly classified into three streams. First, descriptive and anecdotal studies, while offering benchmarks for practitioners to assess and evaluate their environmental sustainability practices and to progress against their peers, provide little value to theory (e.g., Molla 2009). Second, case studies that are micro in orientation, while capturing the richness of the context in which the researched object is embedded in, cannot possibly address the broad macro-level issues (e.g., Haigh 2004; Haigh and Griffiths 2008). The third stream of research is conceptual studies that lay the theoretical foundations for future empirical exploration (e.g., Melville 2010; Watson et al. 2010). This classification of existing studies reveals that there is a dearth of quantitative empirical studies examining "IT-environmental performance" linkage from a global perspective. Hence, the prime motivation of this research is to fill this void by examining the impact of IS innovations in a country on its environmental performance. Specifically, we center upon the IS innovations available with private- and public-sector firms in a country viz., electronic government (e-government) and electronic business (e-business), as governments and businesses are the "ultimate keys" to respond to issues pertaining to national environmental performance.

E-government is defined as the provision and enhancement of government services and operations to the stakeholders in a country using online channels. E-business, on the other hand, is defined as the use of the Internet by commercial firms for improving their business operations and customer service. Although e-government and e-business may be similar in terms of underlying technologies, their *raison d'être* are very dissimilar (Srivastava and Teo 2010). While e-government is meant for providing service to citizens and businesses, e-business exists for conducting commercial activities online. Despite e-government and e-business serving different purposes, extant literature points to the contributions that e-government and e-business make toward enhancing environmental performance (e.g., Box 2002; Choucri 2001; Haigh 2004; Haigh and Griffiths 2008; Yang 2002). In addition, research has also shown that the conditions facilitating the development of e-government and e-business in a nation may be intertwined (Singh et al 2007; Srivastava and Teo 2010). Further, studies examining the role of IS innovations for national development (Srivastava and Teo 2010; Qureshi 2005) indicate "implicit" connections between e-government and e-business. While synergistic relationship between e-government and e-business is often emphasized in the literature, extant studies typically view e-government and e-business as distinct domains of study, thereby creating an "academic disconnect" between the two technological innovations impacting national environmental performance. Hence, in this paper, by utilizing the Technology-Organization-Environment (TOE) theory and the Resource-Based-View (RBV) of a firm as guiding lenses, we first identify the relative importance of contextual factors facilitating e-government and e-business development. Further, grounding the discussion in IT impact literature, we investigate the impacts of e-government and e-

business development on national environmental performance. In sum, the specific research questions that we address in this study are:

***RQ1:** What is the relative importance of the contextual factors facilitating e-government and e-business development in a nation?*

***RQ2:** What is the relationship between e-government and e-business in a nation?*

***RQ3:** What is the relationship of e-government and e-business development in a nation with its environmental performance?*

2 CONCEPTUAL DEVELOPMENT

TOE theory posits that the organizational adoption and implementation of technological innovation is influenced by three contextual elements: technology, organization and environment (Depietro et al. 1990; Tornatzky and Fleischer 1990). **Technological context** refers to characteristics of the technologies available for potential adoption by the organization, and the current state of technology which can be expressed either as material (e.g., equipment owned by the organization) or immaterial (e.g., methods currently in use) (Depietro et al. 1990; Tornatzky and Fleischer 1990). **Organizational context** depicts the organizational structure, the presence of innovation-enabling processes such as informal communication and strategic behaviour of top management, quality of human resource, firm size, and amount of slack resources of the organization (Depietro et al. 1990; Tornatzky and Fleischer 1990). **Environmental context** explains the environmental conditions such as market structure and characteristics, the external support available for adopting new technologies and government regulations (Depietro et al. 1990; Tornatzky and Fleischer 1990). These three contextual factors together influence a firm's innovation adoption decision. We extend this theoretical argument to the development of e-government and e-business systems at the national-level.

While the TOE theory has been widely used in extant IS research, it is often criticized for its inability to provide the theoretical rationale to establish causal relationships (Mishra et al. 2007). In contrast, as individual theories lack the breadth of variables in the TOE theory, and its simple yet elegant taxonomy (Mishra et al. 2007), recent literature in IS has attempted to combine the best attributes of the TOE theory with other theories (Zhu and Kraemer 2005). For instance, Mishra et al. (2007) combined TOE theory with RBV of the firm to examine antecedents and consequences of Internet use in the context of procurement in US manufacturing firms. Consistent with the extant studies, we combine the TOE theory with the RBV of a firm to examine the relative importance of the contextual factors facilitating e-government and e-business development in a nation. Specifically, drawing from RBV of a firm, we propose that the development of e-government and e-business development is facilitated by three resources: (1) ICT infrastructure; (2) Human capital; and (3) Institutions. Each of these three resources represents technological, organizational, and environmental contexts respectively. The quality of ICT infrastructure signifies the level of computer and communications hardware and software available in a country. While the quality of human capital indicates how well educated and trained are the citizens in a nation, the quality of institutions is determined by the legal and administrative framework within which individuals, firms, and governments interact to generate income and wealth in an economy.

Porter (1990) highlights the significance of country's resource configurations in terms of factor conditions, demand conditions, competitive environment and the presence of supporting industries, for achieving its competitive advantage. Specifically, for nations to gain competitive advantage, he highlights the significance of "advanced and specialized" factors such as information and communication networks that are valuable, rare, imperfectly imitable, and non-substitutable rather than "basic and general" factors such as foreign capital. For instance, countries like Singapore, which are devoid of basic and general resources, have become very competitive world due to the proactive focus on advanced and specialized resources like IS innovations (e.g., e-governments and e-business) (Teo and Lim 2004; Srivastava and Teo 2008). A large scale study conducted by the World Economic

Forum (WEF) highlights that if IS innovations plays a central role in enhancing economic performance, it can and must play an equally central role in increasing environmental performance (WEFGIT Report 2009-2010). Consistent with this study and Porter's line of reasoning, we argue that e-government and e-business development in a country will significantly contribute to national competitive advantage in terms of environmental performance.

3 RESEARCH MODEL AND HYPOTHESES

3.1.1 Technological Context

The obligations of government agencies are all permeative and are concerned with the day-to-day activities of citizens and businesses. Governments accomplish such obligations by establishing an association with citizens and businesses through the Internet and related ICT infrastructure. This is possible only when a sound ICT infrastructure is in place to support government's interaction with citizens and businesses. Hence, the presence of a well-developed national ICT infrastructure is vital for the development of e-government. This leads to the following hypothesis:

H1a: *The quality of ICT infrastructure in a country is positively associated with the level of its e-government development.*

Extant firm-level studies highlight the need for sound technological infrastructure within the firm for development and usage of e-business for conducting its transactions (e.g., Subramaniam and Shaw 2002). Extending this argumentation to our context, we propose that a high-quality or well-developed ICT infrastructure at the national-level is essential for proliferation of e-business in a nation. In the absence of a sound and reliable technological infrastructure, e-business development will remain an "unfulfilled aspiration". As ICT infrastructure is imperative for e-business development, we posit:

H1b: *The quality of ICT infrastructure in a country is positively associated with the level of its e-business development.*

3.1.2 Organizational Context

Human capital is a vital resource for organizational development (Bogaert et al. 1994). Studies on e-government indicate citizens as an important stakeholder for e-government deployment and their knowledge as a vital resource that would facilitate the proliferation of e-government (Flak and Rose 2005). Further, citizens' education and training is not only a significant predictor of initial acceptance of e-government systems (Thomas and Streib 2003) but is also a facilitator for continued usage of public e-services (Teo et al. 2008). In other words, educated and trained citizens are one of the major enablers for e-government development (Singh et al. 2007; Von Haldenwang 2004). Thus, better quality of human capital in terms of citizens' education and training should facilitate e-government development in the nation. This leads to the following hypothesis:

H2a: *The quality of human capital in a country is positively associated with the level of its e-government development.*

Following from a similar argument, we posit that citizens' education and training will be imperative for e-business development as educated and trained citizens in a country will be better equipped to use e-business Web sites. Further, educated and trained citizens by being a part of the implementing organization, may also involve in the deployment of various e-business initiatives. Specifically, by utilizing ICT tools such as online discussion forums, email, online surveys, online chat, and group support systems, citizens may interact or communicate with the implementing organization and may provide timely feedback and suggestions for enhancing e-business development process. Thus, we hypothesize:

H2b: *The quality of human capital in a country is positively associated with the level of its e-business development.*

3.1.3 *Environmental Context*

In the context of online public services, prior studies have shown the significance of institutions and government regulations. For instance, Moon (2002) found that government institutional factors contribute to e-government adoption among municipalities. Further, Norris and Moon (2005) highlighted that the adoption and sophistication of e-government services are correlated with institutional factors. Similarly, West (2004) and Von Haldenwang (2004) showed that a sound institutional base in the country is required for the development of e-government. More recently, Srivatsava and Teo (2010) highlighted the importance of environmental context in the form of public institutions for e-government development. Consistent with the above studies, we argue that institutions in form of high quality legal and administrative frameworks in a country will be positively associated with its e-government development. This leads to the following hypothesis:

H3a: The quality of institutions in a country is positively associated with the level of its e-government development.

The quality of institutions also has a strong bearing on growth and development of business by influencing a firm's investment decisions such as e-business development. The presence of a sound institutional environment can substantially mitigate privacy and security related risks of individual users and businesses while using e-business facilities (Srivastava and Teo 2010). That is, institutional arrangements not only serve to restore the confidence of their privacy and security concerns, but also provide means for indemnity in the event of breach. Hence, the presence of a sound institutional environment is an important enabler for proliferation of e-business in a nation. Hence, we propose:

H3b: The quality of institutions in a country is positively associated with the level of its e-business development.

3.1.4 *Relationship between E-Government and E-Business*

Studies examining the role of IS innovations for national development (Srivastava and Teo 2010; Qureshi 2005) indicate "implicit" connections between e-government and e-business. Cohen et al. (2002) in his study found that governmental activities in the public domain will urge similar activities in the business scenario. For instance, in nations like Singapore which have well developed e-government systems, have policies for motivating businesses to deploy e-business facilities (Ke and Wei 2004). Srivastava and Teo (2010) in their study indicate, "governments gain in terms of synergies from the businesses who are better able to interact with the government online...realizing the benefits, businesses also switch to the e-interaction mode which eventually translates to their extensive e-business use." (p. 271). This leads to the following hypothesis:

H4: The level of e-government development in a county is positively associated with the level of its e-business development.

3.1.5 *Impact of E-Government and E-Business*

Previous research has shown that IS innovations can contribute to the organizational performance (e.g., Melville et al. 2004) by deriving competitive advantage from them by altering a range of strategic and industry factors such as cost positions, scale economies, and power relations with buyers and suppliers (Ravichandran and Lertwongsatien 2005). E-government and e-business systems, despite serving different purposes, can contribute toward enhancing environmental performance. The information processing capabilities of e-government and e-business systems give them an important role in progressing organizations and nations towards more sustainable outcomes (Box 2002). It has been argued that both public- and private-sector organizations can bring their IS innovations and environmental performance objectives together so that e-government and e-business can enhance environmental performance through service and cost efficiencies (Prahalad and Hammond 2002). E-government and e-business systems can enhance the environmental performance or deliver positive environmental sustainability outcomes by (1) disseminating environmental performance issues faster

and with broader coverage throughout the nation and its stakeholders (i.e., government and businesses) (Cormier and Magnan 2004; Judge and Douglas 1998); and (2) developing real-time decision support systems that integrate with e-government and e-business systems, and enable managers and policy makers to make operational decisions that are aligned with environmental performance goals (Box 2002). Clearly, national environmental performance which indicates the environmental conditions of a nation is dependent on its technological developments (WEFGIT 2009-2010). Hence, we posit that e-government and e-business development in a nation will impact its national environmental performance. This leads to the following hypotheses:

H5a: *The level of e-government development in a county is positively associated with the level of its national environmental performance.*

H5b: *The level of e-business development in a county is positively associated with the level of its national environmental performance.*

3.1.6 Control Variables

Control variables are used to account for factors other than the theoretical constructs of interest, which could explain variance in the dependent variable. We will use three variables to control for other factors which could influence the dependent variable. These variables are population, population density, and economic conditions. First, as population across different countries vary greatly (e.g., India vs Canada), it is appropriate to control for country's size (in terms of population scores). Second, as the population density gives a direct measurement of county's population pressure on its natural environment (Vachon and Mao 2008), it is appropriate to control for its effect in our study. Third, as economic conditions in a country will reflect different competitive pressures and, therefore, differences in environmental priorities, we will control for its effect in terms of GDP per capita adjusted for purchasing power parity. The proposed research model is shown in Figure 1.

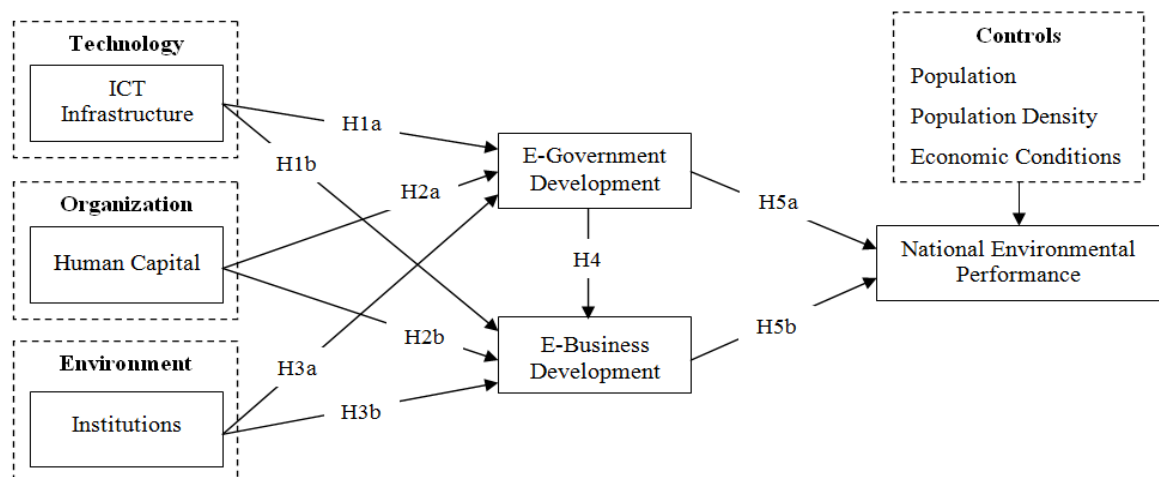


Figure 1. Proposed research model.

4 PROPOSED RESEARCH METHOD AND FUTURE PLANS

4.1.1 Data

We intend to use reliable secondary sources of national-level data to test the proposed model for two reasons. First, collecting large scale primary data from over hundred countries is constrained by the amount of resources and time available for conducting such research (Srivastava and Teo 2008; 2010). Second, secondary data, as suggested by some researchers (e.g., Jarvenpaa 1990) offers several advantages namely, (1) easy reproducibility; and (2) ability to generalize the results arising from larger datasets (Kiecolt and Nathan 1985). We selected three sources that meet our research objectives: (1)

the WEF Global Competitiveness Report; (2) the United Nations (UN) E-government Report; and (3) the Yale Environmental Performance Index Report. All the three sources are considered to be reliable reports and have been widely used in past academic research. For instance, data from the Global Competitiveness Report have been used in studies such as Delios and Beamish (1999), Gaur and Lu (2007), and Srivastava and Teo (2008, 2010). Similarly, the data from UN E-government Report have been used in studies such as Siau and Long (2006), Singh et al. (2007), and Srivastava and Teo (2008, 2010). And, data from the Yale Environmental Performance Index Report have been used in studies such as Feroz et al. (2009) and George (2007).

4.1.2 Variables and Measures

As depicted in our research model (Figure 1), there are six main constructs in this study: TOE contextual factors, e-government development, e-business development, and national environmental performance. Table 1 describes the measures that we intend to use in our study.

Measure	Description
ICT Infrastructure	ICT infrastructure is indicated by the Telecommunication Infrastructure Index and is taken from the UN E-Government Survey Report. This index is a composite of five indicators: number of personal computers per 100 persons, number of Internet users per 100 persons, number of telephone lines per 100 persons, number of mobile cellular subscriptions per 100 persons and number of fixed broadband subscribers per 100 persons. The telecommunication infrastructure index for country is derived as: Telecommunication infrastructure index = Average (personal computer index + Internet user index + telephone line index + mobile subscription index + fixed broadband index).
Human Capital	The variable of human capital is taken from the UN E-Government Survey Report as the Human Capital Index. This index is a composite of the adult literacy rate and the combined primary, secondary and tertiary gross enrolment ratio, with two thirds weight given to the adult literacy rate and one third to the gross enrolment ratio.
Institutions	The construct, institutions is taken from the Global Competitiveness Report. It is determined by the legal and administrative framework within which individuals, firms, and governments interact to enhance competitiveness of a country. This construct is a composite measure of several variables like government inefficiency, ethics and corruption, accountability, security and so on.
E-Government Development	The e-government development construct is indicated by the Web Measure Index and is obtained from the UN E-Government Survey Report. The Web Measure Index is based upon a five-stage model: emerging presence, enhanced presence, interactive presence, transactional presence and networked presence. Countries are coded in consonance with what they provide online and the stage of e-government evolution they are presently in. The Web Measure Index is an indicator of the sophistication and development of the e-government Web sites of that particular country.
E-Business Development	The e-business development construct is indicated by the extent of business Internet use, and is taken from the Global Competitiveness Report. E-business development represents the maturity of nations' businesses in using the Internet for conducting their transactions. It indicates whether the Internet use by businesses in the particular country to conduct its transactions is widespread or is low. The extent of business use of the Internet indicates the level of development of e-business in the country.
Environmental Performance	This construct captures three main aspects of environmental performance on climate change: (1) GHG emissions per capita (including emissions from land use change); (2) CO ₂ emissions per unit of electricity generation; and (3) industrial greenhouse gas emissions intensity. The GHGs in this calculation include CO ₂ from fossil fuels, land use change emissions, and non-CO ₂ gasses like methane and nitrous oxide (NOX), and are measured in metric tons of carbon dioxide equivalents. The lower the per capita emissions, the less the average person in a given country contributes to climate change. The values for these will be taken from the Yale Environmental Performance Index Report.

Table 1. Description of measures

4.1.3 Future Plans

We have successfully identified the reliable sources of data that meets our research objectives. As the proposed environmental performance model includes constructs which also be endogenously determined, we intend to use three-stage least-squares analysis as it provides reliable and more efficient estimates of parameters (Kennedy 1998).

5 EXPECTED CONTRIBUTIONS

Our study is expected to make several key contributions. First, as this research strives to examine the environmental impact of e-government and e-business in a nation, we address the "value" question related to these two Internet enabled interventions. Second, we combine the best attributes of the TOE theory with the RBV of a firm, and apply them in a cross-country scenario for better appreciating the development and impact of e-government and e-business on national environmental performance. Third, by examining the e-government and e-business development in a single model, we not only strive to overcome the "academic disconnect" that is created when researchers looks at either one of the "enacted domains" in their study, but also help policy makers and practitioners in understanding the holistic view of using the IS for managing national environmental performance. Fourth, findings of our study will highlight the key factors important for e-government and e-business development, which in turn may serve as important lessons (pertaining to what to focus the resources on) for countries intending to elevate the level of e-government and e-business development, and enhance the national environmental performance.

6 CONCLUSION

In conclusion, despite an extensive recognition on the importance of IT in causing and resolving issues surrounding environmental sustainability, both research and practitioner communities knows relatively little on how national-level IS innovations can be effectively utilized to manage a country's environmental performance. As an initial step to be taken towards raising awareness for pivotal role of IS innovations (i.e., e-government and e-business) in a country for managing its environmental performance, we, by drawing from RBV and IT impact literature, constructed a theoretical model and will validate it in the light of country-level data taken from reliable secondary sources. Our study, in sum, reiterates the connection between e-government, e-business, and national competitive advantage in terms of environmental performance.

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