



A multidimensional and integrative approach to study global digital divide and e-government development

Fang Zhao

*School of Business and Management, American University of Sharjah,
Sharjah, United Arab Emirates*

Alan Collier

*Centre for Entrepreneurship, University of Otago, Dunedin,
New Zealand, and*

Hepu Deng

*School of Business Information Technology and Logistics, RMIT University,
Melbourne, Victoria, Australia*

Abstract

Purpose – The purpose of this paper is to examine the effects of the digital divide on e-government development.

Design/methodology/approach – The study takes a multidimensional and integrative approach in order to examine the various ways in which different contextual factors affecting the digital divide (i.e. economic, social, political, demographic, cultural and ICT infrastructure) interact to influence e-government development. To test the hypotheses, authors perform a correlation and multiple regression analysis using SPSS.

Findings – After analysing several global data sets such as those of the World Bank and the United Nations, the study finds that the digital divide is a multidimensional construct that has a significant impact on e-government development in various ways. In contrast to the consensus view of a correlation existing between economic status on the one hand, and the digital divide and e-government development on the other, this study finds that economic status is not a significant predictor of the digital divide or e-government development.

Practical implications – The findings should help inform public policy makers when developing strategies to deal with issues of the digital divide and e-government development by encouraging analysis in a holistic and integrative way. Simply addressing the digital divide alone is unlikely to be sufficient to stimulate an increase in the uptake of e-government. Moreover, our model helps identify areas of strengths as well as weaknesses for improvement.

Originality/value – The authors develop a multidimensional and integrative research model to study the digital divide and e-government development and the relationship between the two, and validate the model through systematically testing it with empirical data. This study is among the first to take such an approach.

Keywords Government policy, e-Government, Technology adoption, Digital divide

Paper type Research paper



Introduction

The results of the most recent United Nations e-government survey of its Member States published in 2012 demonstrated that a significant gap exists in e-government development between the developed and developing nations and across different regions. The survey found that one of the causes of the gap is what it called the “digital divide” (United Nations, 2012). The term “digital divide” is widely used to refer to a marked gap in access to, and use of, Information and Communications Technology (ICT) devices (International Telecommunication Union (ITU), 2011). Bridging the digital divide in e-government development has become a focus of interest to both policy makers and researchers in recent years (Mossberger *et al.*, 2003; Bélanger and Carter, 2009; United Nations, 2012). However, as noted in a recent study by Wei (2011, p. 170), “a theoretical account for the effects of the digital divide is currently lacking” although the digital divide has been a public policy issue for over a decade. Helbig *et al.* (2009, p. 89) concluded in their study that “theoretically and practically e-government and digital divide are intertwined social phenomena”. This suggests that there is an intricate relationship between the two and, to understand the nature of this relationship, an analysis in its social context is required. Our literature review found that although there is a significant body of literature on the digital divide and e-government development, few systematic empirical studies have been published that explore and test empirically the apparent relationship between the two (Helbig *et al.*, 2009). We aim to address this knowledge gap in this study. Studies have shown that many factors affect the digital divide and e-government development (Norris, 2001; Van Dijk and Hacker, 2003; Mossberger *et al.*, 2003; Barzilai-Nahon, 2006; Welch *et al.*, 2005; Heeks, 2006; Fuchs, 2009; Grimmelikhuijsen, 2012; Zhao *et al.*, 2012). In this paper we explain how our multidimensional and integrative approach to the study allows us to obtain a better understanding of the relationship between the digital divide and e-government development.

The next section of our paper presents a brief critical review of the key literature. We use this review to develop a research model from which hypotheses on the causes of the digital divide and limited e-government take-up are developed. The paper then describes the statistical procedure used in our analysis and presents the statistical results, while following sections discuss our findings and their implications for theoretical development and practice. At the end of the paper we identify limitations and make suggestions for future study.

Literature review

The construct and research models of digital divide

A considerable amount of research on the digital divide has been published since the 1990s (e.g. Hargittai, 1999; Corrocher and Ordanini, 2002; Barzilai-Nahon, 2006; Dewan and Riggins, 2005; Cuervo and Menendez, 2006; Zheng and Walsham, 2008). The OECD (2001, p. 5) defines the digital divide as “the gap between individuals, households, businesses, and geographic areas at different socioeconomic levels with regard both to their opportunities to access ICTs and to their use of the internet for a wide variety of activities”. This definition suggests that the digital divide encompasses two major divides: an access divide; and a use divide, and that the causes of both divides arise from social and economic disparities. This conceptualization has been widely accepted and used by international institutions such as the OECD and the United Nations (2012).

Researchers have generally analysed the digital divide at one of two levels: either the international digital divide between countries; or the domestic digital divide within

countries. At the international level, studies have shown that a clear divide exists in the access to and use of ICT between developing and developed nations. Economic factors such as economic status, and social factors such as educational attainment have been identified as among the main predictors of the digital divide (Hargittai, 1999; Norris, 2001; Kiiski and Pohjola, 2002; Bagchi, 2005). An international study of 161 developed and developing countries (Chinn and Fairlie, 2006) found that GDP per capita, telecommunications infrastructure, and the quality of regulation are key factors that explain the digital divide. In a similar study, Guillen and Suarez (2005) analysed the data covering 118 countries during the 1997-2001 period and found that the economic disparity and regulatory and sociopolitical characteristics of countries and their evolution over time contributed to inequity in ICT access and use. When analyzing the digital divide some studies have tended to focus on specific groups of people within a nation who appear especially disadvantaged by the digital divide. Such groups include people on low incomes, people with limited education or low literacy levels, ethnic minorities, the unemployed, the elderly, people in isolated or rural areas, people with disabilities, single parents, and women and girls (Cullen, 2001; Helbig *et al.*, 2009).

Researchers have tended to analyse the digital divide usually from one of two perspectives: either using one or only a few variables; or, sometimes, using multiple variables. To date, much of the research in this area has focused on analysis using only a limited number of variables, such as the information technology division between haves and have-nots (Sciadas, 2002). Dewan and Riggins (2005) conceptualized the digital divide as having two aspects: the inequality of access to IT; and the inequality of IT capacity (the ability to use the technology). Wei (2011) argued that the study of digital divide should consider what he called “the outcome divide” in addition to the access and capability divides. Underpinned by social construction theory, other researchers have characterized the digital divide as a multidimensional construct and a complex and dynamic phenomenon, arguing that there are a number of variables relating to the digital divide including individual, community, location, and institutional (Norris, 2001; Van Dijk and Hacker, 2003; Mossberger *et al.*, 2003; Barzilai-Nahon, 2006; Fuchs, 2009). Norris (2001, p. 4), for example, argued that the digital divide has three components: the global divide which refers to the disparity of internet access between industrialized and developing nations; the social divide which is the gap between information rich and poor in a nation; and the democratic divide which “signifies the difference between those who do, and do not, use the panoply of digital resources to engage, mobilize, and participate in public life”. Mossberger *et al.* (2003) went further and posited that the digital divide actually comprises four components: an access divide; a skills divide; an economic opportunity divide; and a democratic divide. Van Dijk and Hacker (2003) continued this theme by describing the digital divide as a multifaceted concept of access including mental access, material access, skills access, and usage access. In a later work, Van Dijk (2006) reviewed the mainstream research on digital divide between 2000 and 2005 and classified the research under four successive types of access: motivational, physical, skills, and usage. Van Dijk’s research found that, in most developed countries, the gap in physical access seemed to be closing whereas the divide in the other three types of access persisted or was widening. The varying conclusions drawn by earlier researchers in this area suggest that there are no agreed terms by which to define or analyse the digital divide. Indeed, Van Dijk (2006) and Fuchs (2009) pointed out that future research will need rigorous and adequate theoretical frameworks capable of defining and measuring the multiple dimensions giving rise to the digital divide.

The ITU (2011) analysed the digital divide within a country using three dimensions, namely: access; use; and skills. Vicente and López (2006) developed a framework to analyse the digital divide among fifteen nations in the European Union (EU). Key indicators in their framework included the price of ICT access and use, the quality of the services, and the expected benefits from use. It is interesting to note that these authors posited that the digital disparities reflected, by and large, the social and economic imbalances across the countries studied. However, their framework did not include any socioeconomic indicators. Unlike the model of Vicente and López (2006), Bagchi (2005) used a multidimensional model drawing on previous works to study the global digital divide. The Bagchi model contains four types of indicators: economic (e.g. GDP per capita); social (e.g. secondary education average); ethno-linguistic (e.g. ethnic heterogeneity); and infrastructural indicators (e.g. electricity). While this model is more comprehensive in scope than its predecessors, the results of his study showed that ethno-linguistic factors were not a significant predictor of the digital divide, a topic which needs to be further studied in the digital divide literature (Bagchi, 2005).

Drawing on the extant literature reviewed above, we argue that the digital divide is a multidimensional construct and should be studied in the context of economic, social, political, demographic, and cultural aspects as well as ICT infrastructure. We also focus on the international rather than the domestic digital divide so that the findings of this study will have potentially wider application to international institutions and policy makers.

E-government: the concept and history

E-government is generally viewed as a multifaceted concept, having different meanings to different constituents. The concept was introduced to public administration in the wake of private-sector adoption of e-business and e-commerce (Gauld and Goldfinch, 2006). E-government has distinctive technical and commercial features (Fishenden and Thompson, 2012), and shares many features with e-commerce in terms of offering e-services and online transactions, but it goes well beyond analogies to e-commerce. The World Bank (2008) defined e-government as the use of information technology to improve the business processes and service delivery of government departments and other government entities. Luna-Reyes *et al.* (2012) posited that e-government has four dimensions: e-services (providing public services), e-management (improving managerial effectiveness), e-democracy (promoting democratic values and mechanisms), and e-policy (developing public policies). Therefore, the development of e-government involves many factors including quality of information, technological infrastructure, organizational and management characteristics, legal and regulatory environment, and economic and social contexts. As in the case of the digital divide, there is an emerging trend that understanding e-government requires it to be analysed using multiple perspectives. Therefore, we adopt a multidimensional view of e-government in our study.

E-government first began appearing in the mid-1990s. Since then it has been embraced by almost all Member States of the United Nations, although there has been significant variation among nations in its development (United Nations, 2012). International studies (Metaxiotis and Psarras, 2004; Gil-García and Pardo, 2005; Heeks, 2006; Gouscos *et al.*, 2007; Kumar *et al.*, 2007) indicate that e-government is likely to provide citizens with added values of “easier, more convenient, better quality, reduced turnaround times”. Furthermore, the implementation of e-government initiatives has

been reported as stimulating business process change, increasing internal efficiency, improving levels of information sharing and interoperation, improving innovation and competitiveness, enhancing social inclusion, greater transparency and accountability, and greater proximity to citizens (Scholl, 2001; European Commission, 2005, 2006; Kaylor, 2005; Guijarro, 2007). At the same time, e-government development and the realization of its potential benefits have faced serious challenges due to the complexity of the technology involved, constraints imposed by providers' capacity, and the limited uptake of e-government by citizens.

E-government development and digital divide

From a social and economic perspective, the study by Bélanger and Carter (2009) of a group of American citizens from diverse backgrounds found that income, education, age, and frequency of internet use were the dominant factors affecting citizens' intentions to take up e-government services. This finding suggests that disparities in socioeconomic background and computer skills may have a significant effect on e-government adoption. Disparities in e-government take-up also suggest the emergence of a new divide: an e-government divide. To investigate this divide, sociological study has been introduced to e-government research, with factors such as social inequality and poverty potentially being implicated in the digital divide and the e-government divide (Thomas and Streib, 2003; Mossberger *et al.*, 2003; Heeks and Bailur, 2006; Reece, 2006; Gouscos *et al.*, 2007; Helbig *et al.*, 2009; Bélanger and Carter, 2009; Al-Shafi and Weerakkody, 2010; Björn *et al.*, 2012). However, these studies were either conceptual only or were confined to analyzing only one or a few countries. Based on our extensive search of the relevant literature there appears to have been no global empirical study published which examines specifically the effects of the digital divide on e-government development. It is the intention of our study to address this knowledge gap.

It should be noted that the effects of the digital divide are context-based. The factors that affect internet or e-commerce use may not be the same as those that affect e-government use, and the degree that the digital divide has on e-government development may not be the same as those affecting general internet use (Bélanger and Carter, 2009). The reasons for this could be that e-government users may have different motivations and purposes from general internet users, and may need to possess more complex skill sets than general internet users. The study by Thomas and Streib (2003) compared general internet adoption with e-government adoption in the USA and found that among internet users, ethnicity and education were important predictors of which internet users would also use government web sites. They found that "the digital divide is even more pronounced among government web site visitors than among internet users in general" (Thomas and Streib, 2003, p. 83). The most recent empirical study conducted in Germany by Björn *et al.* (2012) found that there were significant differences in the factors that influenced use among the broad population of, respectively, e-government and the internet. Drawing on this line of argument, we speculate whether other factors such as government effectiveness and government web site content may also affect e-government development.

A multidimensional and integrative research model

Drawing on the preceding discussion, we were convinced that a more accurate understanding of the factors affecting e-government use would be likely to result from using a multidimensional and integrative approach. To do this we would need to

identify reliable and robust data on as many of the factors identified in our literature review as possible with the potential to influence e-government use, while making the results as universal as possible by using data covering many countries. This approach would allow us to examine the various ways in which different contextual factors of the digital divide (i.e. economic, social, political, demographic, cultural, infrastructure, and web site content) interact to influence e-government development. Figure 1 presents our research model based on this approach. Our research model differs from existing models, such as that used by ITU (2011) for the measurement of the digital divide and the model of Bélanger and Carter (2009) for the study of the digital divide effect on e-government usage. While the ITU’s model focused on access, use and skills, and that of Bélanger and Carter looked into the effects of socioeconomic, demographic, and skill factors on e-government adoption, our model adopts a multidimensional and integrative approach by studying both the digital divide and e-government development from the perspectives of economic, social, political, demographic, and cultural aspects as well as ICT infrastructure. Moreover, unlike the earlier studies discussed in this paper, our model distinguishes the contributors to the digital divide from the indicators of the digital divide. For the sake of clarity, we take internet use as an indicator of digital divide and other factors as possible contributors.

Hypotheses and measures

This section explains in detail the hypotheses illustrated in Figure 1 and specifies the measures used to test the hypotheses.

Digital divide and e-government development

The preceding discussion suggested that e-government development is affected by the digital divide (Bélanger and Carter, 2009; Helbig *et al.*, 2009; United Nations, 2012). We, therefore, intend to test empirically the relationship between the two by hypothesizing that:

H1. The digital divide affects e-government development.

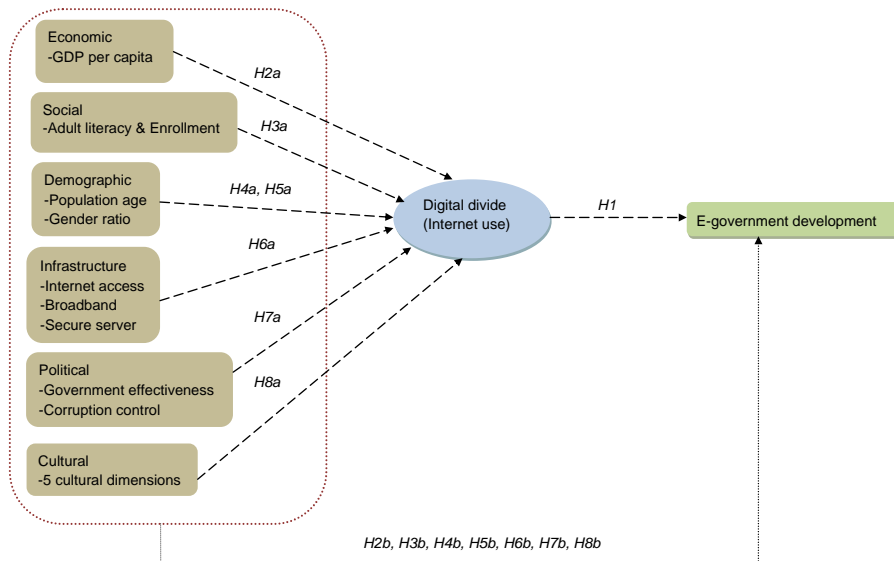


Figure 1.
A multidimensional
and integrative research
model for the study of
digital divide and
e-government development

As discussed in our literature review, various models may be used to define the digital divide. Indeed, how to measure the digital divide appears to vary depending on the primary interests of the researcher. For example, the ITU (2011) measured the digital divide of a country by analyzing three factors: internet access, skills, and internet use, because it considered educational training to be an important factor contributing to the digital divide. The widely accepted OECD (2001, p. 5) definition of the digital divide suggested that it comprised two principal elements: an access divide; and a use divide. We argue that having internet access and skills is a necessary pre-condition to internet use and, therefore, access and skills are contributing factors to but are not, in themselves, indicators of the digital divide. For the purpose of operationalization of the digital divide for hypothesis testing, we have identified internet use as a valid proxy by which to express the digital divide. There are two principal reasons for this. First, this study seeks to examine the various ways in which different contextual factors affect the digital divide (i.e. economic, social, political, demographic, cultural factors, and ICT infrastructure). To do this, we need to examine the relationships between the diffusion (i.e. the actual use of the internet) and the contextual factors. We posit that having access to the internet and/or having the skill to use the internet do not necessarily correlate with actual use of the internet and, therefore, we hypothesize them as being contextual factors (independent variables) for empirical testing while taking the actual use of internet as the dependent variable. Second, due to the numerous definitions of digital divide in different countries, there is a lack of harmonized data available to measure the digital divide at the international level. Vehovar *et al.* (2006) found that many of the current composite indexes of digital divide take different or even contradictory values. For example, a country may have higher penetration rates of broadband (one of the indicators in the composite index of digital divide) but lower levels of internet diffusion (another indicator in the composite index). Therefore, to avoid possible conflicting results from a composite index, we elected to use a single, but the most important, indicator of the digital divide, namely, internet use. Our study uses the ITU (2011) data on internet use per 100 inhabitants as a robust proxy of the digital divide.

The United Nations Department of Economic and Social Affairs conducted six consecutive surveys (once each two years) since 2003 for the purpose of assessing global e-government development. Using these surveys, an e-government development index score was calculated to indicate the level of e-government development achieved by each Member State. We have used the index scores from the latest survey (United Nations, 2012) as the measure of e-government development for the purpose of our statistical analysis.

Economic factors

Economic disparity is generally viewed as a key contributor to the digital divide and e-government development (Norris, 2001; Chinn and Fairlie, 2006; Bélanger and Carter, 2009; United Nations, 2012). For example, the latest e-government survey of the United Nations (2012) indicated that there was a significant gap between developed and developing countries in e-government diffusion. In other words, richer countries performed better than poorer countries. However, the survey did not measure explicitly the association between economic status and e-government diffusion. To test this possible association, we hypothesize that:

H2a. Economic disparity is associated with the digital divide.

H2b. Economic development has a positive effect on e-government development.

We selected GDP per capita from the United Nations global study as the economic status indicator because of its clear link in measuring the economic strength of a country as well as being an indicator of a country's standard of living. ICT expenditure as a proportion of GDP can be another robust economic indicator as shown by Norris (2001). However, these data are not available for most countries and are, therefore, not included in our data analysis.

Social factors

The earlier discussion in the literature review has shown that the level of educational attainment required by individuals to use ICT effectively affects positively the digital divide and e-government use (e.g. Bélanger and Carter, 2009). We hypothesize that:

H3a. Education has a positive effect on the digital divide.

H3b. Education has a positive effect on e-government development.

To test this hypothesis, we selected the latest "human capital index" published by the United Nations (2012) as the relevant proxy for national education attainment. This is a composite index encompassing two indicators of a country's aggregate level of education: adult literacy rate; and the combined primary, secondary, and tertiary gross enrolment ratio. An alternative measure of the digital divide could have been done using data on income inequality (GINI) collected by the World Bank (Bagchi, 2005), however, we were not able to use GINI because a large number of countries' data were missing (World Bank, 2012).

Demographic factors

Research published to date has not demonstrated a consistent correlation between the digital divide and demographic characteristics such as age and gender. For example, Van Dijk and Hacker (2003) conducted a multivariate analysis of Dutch official statistics and found that age and gender have the same significant effect on digital divide as education. On the other hand, the study by Bélanger and Carter (2009) conducted in the USA suggested that age (although not gender) was an important predictor of the digital divide in e-government diffusion. On the basis that women are often underrepresented in schools and the workforce in many developing nations compared with developed nations (World Bank, 2012), we elected to include both age and gender as possible demographic predictors of the digital divide and e-government development. The study by Thomas and Streib (2003), also conducted in the USA, found that e-government users were more likely to be white, younger, more educated and have higher income than other internet users. Ethnicity or race has been identified by some researchers as a demographic factor that affects the use of the internet and e-government within a country (Mossberger *et al.*, 2006; Thomas and Streib, 2003). Because our study focused on the international digital divide, we elected not to include ethnicity in our data analysis. Our hypotheses in this case became:

H4a. Age is associated with the digital divide.

H4b. Age is associated with e-government development.

H5a. Gender is associated with the digital divide.

H5b. Gender is associated with e-government development.

To test these hypotheses we used data on age structure and gender ratio between ages 15 and 64 collected and published by the USA Central Intelligence Agency in its Factbook (CIA, 2011) as relevant proxies for age and gender in our analysis.

ICT infrastructure

The extent of national ICT infrastructure indicates the level of ICT advancement, with differences between countries generally viewed as a measure of the national digital divide (Vicente and López, 2006; ITU, 2011). E-government depends on the presence of ICT infrastructure and, therefore, we assume that the level of e-government development of a country is affected by the development of its ICT infrastructure. This led us to hypothesize that:

H6a. ICT infrastructure development has a positive effect on the digital divide.

H6b. ICT infrastructure development has a positive effect on e-government development.

While there are many indicators of ICT infrastructure available, we elected to use those that are most important and relevant to e-government development, namely: fixed broadband; internet access; and secure internet servers. Data on the ICT infrastructure in countries relevant to our analysis have been collected by the ITU (2011).

Political factors

Studies suggest that political factors such as democracy and government regulation can affect the extent of the digital divide (Van Dijk and Hacker, 2003; Guillen and Suarez, 2005; Fuchs, 2009). According to case studies conducted in three different countries, one of the most important factors contributing to e-government development was the political will and commitment at the highest level of government (Yildiz, 2007; Ahmed, 2002; Olivier, 2002). The national regulatory environment has also been identified as playing a key role in e-government development (Hambleton, 2004). Government, in its role as policy and decision maker, undoubtedly has the power and resources to play a critical role in determining internet use and e-government development. Recognizing this role of government, the United Nations (2012) called on the governments of its Member States to reduce the digital divide and increase access to public services by vulnerable populations and distant communities. However, there is not a simple linear relationship between use of the internet and the adoption and use of e-government. In this regard trust in government has been identified as being important to e-government adoption by citizens (Carter and Bélanger, 2005). Further, Tolbert and Mossberger (2006) found that there was a statistically significant relationship between trust in government and the use of government web sites. Some factors contributing to trust in government have been identified as including integrity, competence, democracy, and transparency of government (Welch *et al.*, 2005; Kovačić, 2005; Grimmelikhuijsen, 2012). Drawing on this line of argument, we hypothesize that

government performance may affect the digital divide and e-government development in the following way:

- H7a.* Government effectiveness and control of corruption have a positive effect on digital divide.
- H7b.* Government effectiveness and control of corruption have a positive effect on e-government development.

To test this hypothesis we selected two indicators of government performance from the Worldwide Governance Indicators (WGI) project developed by the World Bank (2011): government effectiveness; and control of corruption. Government effectiveness measures the quality of public services, policy formulation and implementation, and the credibility of the government's commitment to such policies, while control of corruption measures the level of government corruption, accountability, and transparency (World Bank, 2011).

Culture

Studies show that culture (referring to national culture in this paper) has a significant effect on technology diffusion (Dwyer *et al.*, 2005; Tifferet and Herstein, 2010). For example, Hofstede (2001) states that low-uncertainty-avoidance cultures make greater use of a recent technological innovation, the internet, than do high-uncertainty-avoidance societies. However, the effect of cultural values on e-government development is often neglected in the world e-government literature and official international surveys. For example, the six consecutive e-government surveys conducted by the United Nations took telecommunication infrastructure and level of education (being part of socioeconomic factor) as key determinants of a country's e-government development index (United Nations, 2012). However, the surveys did not consider cultural values, religious beliefs, or social norms, all of which may play an important role in e-government implementation and adoption (Zhao, 2013). Culture, as a source of acceptable norms and behaviours, may influence online expectations, preferences, and experiences of the public and their attitudes towards e-government (Gefen *et al.*, 2006). For example, adopting a new concept such as e-government may be regarded in some cultures as being in conflict with the dominant group norm. In this case, people from countries with a strong emphasis on group behaviour may exhibit a lower degree of e-government adoption, while, on the other hand, people from countries where individualism is more acceptable are likely to be more inclined to innovate and adopt new ideas such as e-government (Erumban and de Jong, 2006; Khalil, 2011). Doney *et al.* (1998) found that culture is an important factor capable of influencing citizens' trust in e-government. Therefore, we conclude that culture should be included in the study of the digital divide and e-government development. In this regard our hypothesis becomes:

- H8a.* Culture has an effect on the digital divide.
- H8b.* Culture has an effect on e-government development.

Culture can be measured in various ways, with two of the most influential culture indexes being Hofstede's culture index (Hofstede, 2001), and House *et al.*'s culture index

(House *et al.*, 2004). For our study we have selected Hofstede's culture index because of its larger data set of 84 countries (House *et al.* cover only 55 countries). Although research has been carried out using Hofstede's (2001) or House *et al.*'s (2004) indexes to study the relationships between culture and technology diffusion (Dwyer *et al.*, 2005; Srite and Karahanna, 2006; Zhang and Maruping, 2008), relatively little has been published using the indexes to identify specifically the effect of culture on e-government development (Kovačić, 2005; Khalil, 2011; Zhao, 2013). We aim to contribute to this important area. Hofstede measured culture largely from five dimensions (A sixth dimension – indulgence vs restraint – was added later on to his indexes. Because far fewer countries were measured and included, we decided not to include this dimension in our study.) The five cultural dimension indexes are power distance index (PDI); uncertainty avoidance index (UAI); individualism-collectivism index (IDV); masculinity-femininity index (MAS); and long-term orientation (LTO) index. Using Hofstede's five cultural indexes, the study of Zhao (2013) found that individualism (i.e. the extent to which an individual is integrated into a group), power distance (i.e. the extent to which a society accepts the differences and inequalities in power distribution), and LTO (i.e. the extent to which a culture programs its members to accept delayed satisfaction of their material, social, and emotional needs) are significantly correlated with e-government development. This study also found that uncertainty avoidance (UA) (i.e. the extent to which members of a society feel uncomfortable in ambiguous and uncertain situations and take actions to avoid them) as well as masculinity (i.e. the extent of distribution of emotional roles between the genders) are not significantly correlated to e-government development. Based on the findings of this study and the others cited above, we posit that the effects of culture on the digital divide and e-government may vary among its five dimensions and, therefore, it is necessary to test the relationships between each of the cultural dimensions and the digital divide and e-government development (this can be seen in Figure 1 – our research model).

In term of Hofstede's index scores, each index represents a cluster of related values (a dimension), and each country receives a single numeric score for each index. The index scores that are currently available and used for this study comprise 84 countries for the first four indexes (PDI, UAI, IDV, and MAS) and 76 countries for the fifth index (LTO). While no published data set appears to provide cultural index scores for all Member States of the United Nations, using these data we can include a majority of countries and regions of the world.

Statistical procedures

To test our hypotheses (*H1-H8*), we performed a correlation and standard multiple regression analysis using SPSS, exploring the relationships among several variables that may be related to the digital divide and e-government development. To address the potential problem of multicollinearity in our multiple regression analysis, we examined the variance inflation factors and found that none of the factors tested exceeded 10.0 (see Appendix for more detail). All the case to independent variable ratios in the multiple regression analysis exceeded the preferred ratio of 15 to 1. Table I presents a summary of the variables and measures that we used for the statistical analysis.

Results

Table II presents the descriptive statistics of means and standard deviations and bivariate correlations among the variables studied. This table shows that there was

Variables	Measures	Data source
Economic	GDP per capita	World Bank (2011)
Social	Adult literacy & Enrolment	World Bank (2011)
Demographic	Population age (age 15-64)	CIA (2011)
	Gender ratio (age 15-64)	CIA (2011)
	Internet access	ITU (2011)
Infrastructure	Fixed broadband	ITU (2011)
	Secure internet server	ITU (2011)
	Government effectiveness	World Bank (2011)
Political	Corruption control	
	5 cultural dimensions	Hofstede (2001)
Cultural	Internet use	ITU (2011)
Digital divide	E-government development	United Nations (2012)
E-government Development		

Table I.
Summary of variables
and measures

a strong correlation between the digital divide (measured by internet use) and e-government development ($r=0.908$, $p<0.01$). A graphic presentation of the relationship between the two is presented in Figure 2. This result supports our hypothesis *H1*.

This table also suggests that the variables which were significantly correlated with the digital divide include economic ($r=0.730$, $p<0.01$ for GDP per capita), social ($r=0.673$, $p<0.01$ for education), demographic ($r=0.192$, $p<0.05$ for gender; and $r=0.620$, $p<0.01$ for age), political ($r=0.858$, $p<0.01$ for government effectiveness; and $r=0.795$, $p<0.01$ for corruption control), and infrastructure factors ($r=0.601$, $p<0.01$ for server; $r=0.848$, $p<0.01$ for internet access; and $r=0.861$, $p<0.01$ for broadband), and two of the cultural dimensions: power distance ($r=-0.516$, $p<0.01$), and individualism ($r=0.675$, $p<0.01$).

As to e-government development, significant correlations were found to exist between e-government development and economic ($r=0.673$, $p<0.01$ for GDP per capita), social ($r=0.816$, $p<0.01$ for education), demographic ($r=0.151$, $p<0.05$ for gender; and $r=0.697$, $p<0.01$ for age), political ($r=0.848$, $p<0.01$ for government effectiveness; and $r=0.754$, $p<0.01$ for corruption control), and infrastructure factors ($r=0.541$, $p<0.01$ for server; $r=0.828$, $p<0.01$ for internet access; and $r=0.808$, $p<0.01$ for broadband), and two of the cultural dimensions: power distance ($r=-0.498$, $p<0.01$) and individualism ($r=0.587$, $p<0.01$).

To further explore the correlations and identify any significant predictors affecting the digital divide and e-government development, we conducted a multiple regression analysis. Table III summarizes the regression results for the digital divide and Table IV for e-government development.

The regression results demonstrate that government effectiveness, broadband, internet access, education, gender, and age were all significant predictors of the digital divide. These variables accounted collectively for about 89 per cent of variation ($R^2=0.885$). Internet access was identified as the best predictor ($\beta=0.327$, $p<0.01$) followed by broadband ($\beta=0.323$, $p<0.01$). However, surprisingly, we found that GDP per capita was not a significant predictor, together with corruption control, and secure server (see Table III for detail).

Table IV presents the regression results for e-government development. Five out of ten variables tested were identified as significant predictors of e-government development: internet use, education, government effectiveness, corruption control,

Table II.
Means, standard deviations, and correlations of variables studied

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. E-government development	0.493	0.205															
2. Education	0.722	0.205	0.816**														
3. GDP per capita	14119	21521	0.673**	0.447**													
4. Server	364	850	0.541**	0.356**	0.724**												
5. Gender Ratio	0.984	0.266	0.151*	0.060	0.280**	-0.055											
6. Age	63.8	6.6	0.697**	0.689**	0.380**	0.209**	0.259**										
7. Govt. Effectiveness	-0.058	0.981	0.848**	0.595**	0.701**	0.568**	0.214**	0.565**									
8. Corruption control	-0.053	0.992	0.754**	0.540**	0.709**	0.585**	0.216**	0.473**	0.908**								
9. Internet access	24.1	29.5	0.828**	0.560**	0.670**	0.407**	0.177*	0.527**	0.771**	0.711**							
10. Digital divide (Internet use)	33.1	27.7	0.908**	0.673**	0.730**	0.601**	0.192**	0.620**	0.858**	0.795**	0.848**						
11. Broadband	8.8	11.9	0.808**	0.567**	0.758**	0.794**	0.031	0.447**	0.782**	0.766**	0.693**	0.861**					
12. Power distance	62.8	21	-0.498**	-0.371**	-0.514**	-0.658**	0.110	-0.001	-0.621**	-0.652**	-0.491**	-0.516**	-0.627**				
13. Uncertainty avoidance	66.8	21.5	0.039	0.154	-0.138	-0.245*	0.013	0.062	-0.170	-0.131	-0.050	-0.033	-0.020	0.206			
14. Individualism	41.6	22	0.587**	0.485**	0.605**	0.646**	0.030	0.160	0.671**	0.672**	0.671**	0.675**	6.88**	-0.619**	-0.190		
15. Masculinity	49.8	17.3	-0.050	0.030	-0.024	-0.172	0.085	0.103	-0.054	-0.152	0.001	0.008	-0.090	0.115	-0.044	0.132	
16. Long-term orientation	37.8	20.3	0.208	0.184	0.040	0.137	-0.272*	0.252*	0.124	0.051	0.167	0.129	0.247*	0.008	-0.045	-0.047	-0.091

Notes: * $p < 0.05$; ** $p < 0.01$

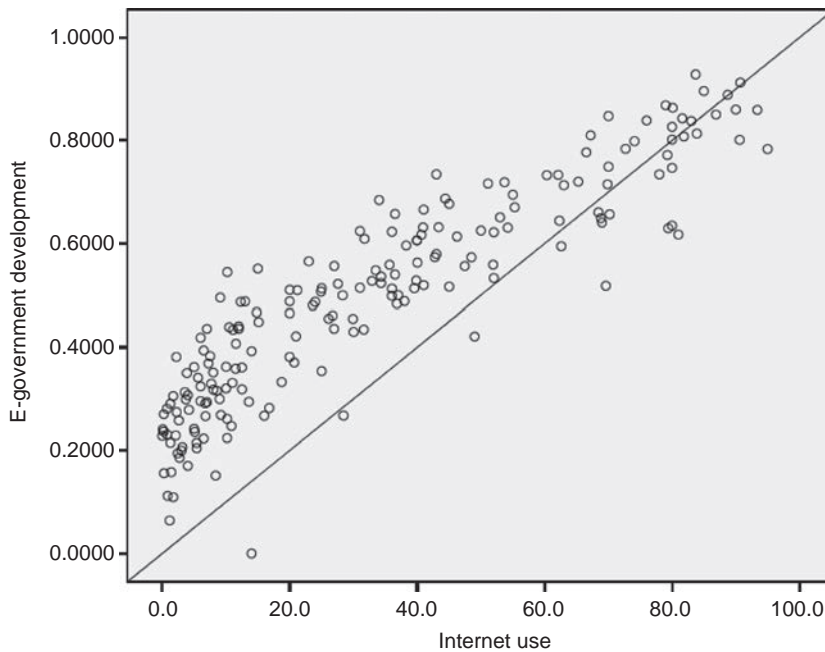


Figure 2.
Relationship between
internet use and
e-government
development

Variable	<i>B</i>	Digital divide SE <i>B</i>	β
Education	15.923	5.886	0.107**
Gender ratio	11.010	3.795	0.094**
Age	0.395	0.171	0.088*
GDP per capita	0.005	0.000	0.013
Government Effectiveness	8.701	2.094	0.299**
Corruption Control	-0.950	1.849	-0.034
Broadband	0.731	0.172	0.323**
Internet access	0.767	0.161	0.327**
Server	0.003	0.002	0.099
R^2		0.885	
<i>F</i>		137.58**	

Table III.
Summary of results of
standard multiple
regression analysis for
digital divide*

*Notes: $n = 171$; digital divide is measured by Internet use (ITU, 2011). ** $p < 0.01$. * $p < 0.05$

and age. Among them, education was found to be the best predictor ($\beta = 0.322$, $p < 0.01$) and the second predictor was government effectiveness ($\beta = 0.319$, $p < 0.01$). Internet use as a proxy for the digital divide in this study was again found to be significantly associated with e-government development ($\beta = 0.306$, $p < 0.01$). But GDP per capita, secure server, internet access, broadband, and gender were not significant predictors.

To examine whether culture has an effect on the digital divide and e-government development, we focused on three variables: culture, digital divide, and e-government development. Table V summarizes the results. Of the five cultural

Table IV.
Summary of results of
standard multiple
regression analysis
for e-government
development

Variable	E-government development		
	<i>B</i>	SE <i>B</i>	β
Education	0.344	0.037	0.322**
Gender ratio	0.011	0.024	0.013
Age	0.002	0.001	0.067*
GDP per capita	0.007	0.000	0.040
Government effectiveness	0.067	0.013	0.319**
Corruption control	-0.029	0.011	-0.142*
Broadband	0.002	0.001	0.120
Internet access	0.002	0.001	0.106
Servers	0.005	0.000	0.070
Internet use (proxy for digital divide)	0.002	0.000	0.306**
R^2		0.913	
<i>F</i>		178.34**	

Notes: $n = 171$. ** $p < 0.01$; * $p < 0.05$

Table V.
Summary of standard
regression analysis for
effects of cultural
variables on digital divide
and e-government
development ($n = 76^a$)

Variable	Digital divide			E-government development		
	<i>B</i>	SE <i>B</i>	β	<i>B</i>	SE <i>B</i>	β
Power distance (PD)	-0.178	0.147	-0.138	-0.001	0.001	-0.172
Uncertainty avoidance (UA)	-0.130	0.110	-0.102	-0.002	0.001	-0.182*
Individualism (IND)	0.748	0.140	0.611**	0.005	0.001	0.0561**
Masculinity (MAS)	-0.067	0.135	-0.044	-0.001	0.001	-0.097
Long-term orientation (LTO)	0.208	0.111	0.159	0.002	0.001	0.235**
R^2			0.498			0.499
<i>F</i>			13.8**			13.9**

Notes: ^aData on cultural dimensions are available for 76 countries only (Hofstede, 2001). * $p < 0.05$; ** $p < 0.01$

dimensions of Hofstede (2001), only individualism (IND) was found to be significantly correlated with the digital divide (measured by internet use) ($\beta = 0.611$, $p < 0.01$). However, three out of the five cultural variables were found to have a significant effect on e-government development. They were individualism ($\beta = 0.561$, $p < 0.01$), LTO ($\beta = 0.235$, $p < 0.01$), and UA ($\beta = 0.182$, $p < 0.05$).

In summary, as shown in Table VI, the results of our statistical analysis sustained our hypotheses *H1* (digital divide and e-government development), *H3a* and *H3b* (education), *H4a* and *H4b* (age), *H5a* (gender in relation to digital divide), and *H7b* (political factor in relation to e-government development). Hypotheses *H6a* and *H6b* (infrastructure), *H7a* (political factor in relation to digital divide), and *H8a* and *H8b* (culture) were partially sustained, while hypotheses *H2a* and *H2b* (economic factor) and *H5b* (gender in relation to e-government development) were rejected.

Discussion

Digital divide – A multidimensional construct

As discussed in our literature review, there is a multitude of conceptualizations of the digital divide in the extant literature. Researchers split on whether the digital divide should be explained primarily based on one factor (e.g. ICT infrastructure or economic

Hypothesis	Sustained	Rejected
H1: The digital divide affects e-government development	✓	
H2a: Economic disparity is associated with the digital divide		×
H2b: Economic development has a positive effect on e-government development		×
H3a: Education has a positive effect on the digital divide	✓	
H3b: Education has a positive effect on e-government development	✓	
H4a: Age is associated with the digital divide	✓	
H4b: Age is associated with e-government development	✓	
H5a: Gender is associated with the digital divide	✓	
H5b: Gender is associated with e-government development		×
H6a: ICT infrastructure development has a positive effect on the digital divide	Broadband, Internet access	Server
H6b: ICT infrastructure development has a positive effect on e-government development	Internet use	Broadband, Server, Internet access
H7a: Government effectiveness and corruption control have a positive effect on digital divide	Government effectiveness	Corruption control
H7b: Government effectiveness and corruption control have a positive effect on e-government development	✓	
H8a: Culture affects digital divide	IND	PD, UA, MAS, LTO
H8b: Culture affects e-government development	IND, UA, LTO	PD, MAS

Table VI.
Summary of results of hypotheses testing

factors) or multiple factors. Some researchers have argued that the digital divide is a multidimensional construct because various factors contribute to it (Norris, 2001; Van Dijk and Hacker, 2003; Mossberger *et al.*, 2003; Barzilai-Nahon, 2006; Fuchs, 2009; Billon *et al.*, 2009). Bagchi (2005, p. 50) explained that the digital divide is “a sociological phenomenon reflecting broader contextual factors such as existing social, economic, cultural, and learning inequalities”. Bruno *et al.* (2010, p. 17) argued that “the digital divide is a complex, dynamic, multifaceted concept”. The findings of our study support this argument, and we conclude that ICT infrastructure is only one of the factors that affects the extent of the digital divide in a country, and that political, social, demographic factors, and culture are all associated with the digital divide (see Table II for the correlation test results). This finding verifies the conceptualization of the multidimensional nature of the digital divide. The finding also suggests that our holistic approach to the effect of digital divide on e-government development is correct.

Economic factors and digital divide

While some studies have suggested that economic wealth is one of the key factors explaining the digital divide (e.g. Norris, 2001; Chinn and Fairlie, 2006; United Nations, 2012; Cruz-Jesus *et al.*, 2012), our research findings did not support this consensus view. Our statistical analysis showed that although economic status correlated with all the variables except for some of the cultural variables in our bivariate correlation results (see Table II), it was not a significant *predictor* of the digital divide in our multiple regression test when multiple variables were examined (see Table III). Unlike other research that uses composite indexes which often include a number of ICT

indicators as well as internet use to measure the digital divide (ITU, 2011), we selected a single variable – internet use – to measure the digital divide (see our justification for this in our preceding discussion). Economic factors may have a significant impact on the establishment of and access to ICT infrastructure but may not be the key factor that determines the actual use of ICT because other factors such as government support, education and training, and culture may be more directly related to the digital divide than the economic status of a country. Drawing on a cross-country database, the study of Liu and San (2006) found that national disparities in ICT adoption are caused by more factors than simply that of GDP, and suggested that factors other than economic development affect the degree of internet use. This finding supports our argument that the digital divide is not simply a matter of economic disparity but rather a multidimensional construct (e.g. Barzilai-Nahon, 2006; Fuchs, 2009; Billon *et al.*, 2009).

Effects of digital divide and other factors on e-government development

The results of this study provide empirical evidence that the digital divide has a significant impact on e-government development, which supports the conclusions of most earlier studies (Thomas and Streib, 2003; Mossberger *et al.*, 2003; Heeks and Bailur, 2006; Reece, 2006; Gouscos *et al.*, 2007; Helbig *et al.*, 2009; Bélanger and Carter, 2009; Al-Shafi and Weerakkody, 2010; Björn *et al.*, 2012). Our results also demonstrate that, like the digital divide, e-government development is affected by many contextual factors which, in turn, confirms the validity of our multidimensional approach to the study. It was not really surprising to find that the social, political, demographic and infrastructure factors that influence the digital divide were also generally associated with e-government development. This finding indicates that, in order to understand the effects of the digital divide on e-government development, we must examine the effects of other important contextual factors that influence the digital divide as well as e-government development.

Of the set of contextual factors we identified, the social, political and cultural factors were found to have greater impact on e-government than on digital divide (see Table III-V). This finding highlights the importance of education, government, and culture in implementing and adopting e-government services. From the supply side, the commitment and leadership of government as the provider of e-government services as well as being the policy maker are crucial to e-government development (Ahmed, 2002; Olivier, 2002; Yildiz, 2007). For example, a government's policy and practice regarding investment in ICT infrastructure and education directly affects the level of e-government development. The study by Gant (2008) suggested that the degree of e-government development could be explained in terms of the perceived administrative benefit from adopting e-government services, the political nature of online applications, the government's organizational capacity in adopting new information technology, and the diffusion effect of e-government service technology. In this regard, it is imperative that government has the organizational and technological capacity to provide citizens with effective and efficient e-services.

From the demand side, earlier studies suggest that citizens' attitude and intention to take up e-government services are influenced by their cultural orientations (Kovačić, 2005; Zhao, 2013). Our study provides further empirical evidence about the association between culture and e-government development. We have shown that, of the cultural dimensions described by Hofstede (2001), individualism is the best predictor of e-government development, followed by LTO and UA. People in countries where

individualism is a dominant characteristic tend to be more innovative and more likely to accept new ideas and technology (Erumban and de Jong, 2006). The fact that e-government is a relatively new concept involving new technology adoption may explain why e-government development occurs more quickly among cultures that embrace notions of individualism (Zhao, 2013). Our study also confirms that there is a positive correlation between LTO (Hofstede's fifth dimension) and e-government development. This result is consistent with the empirical study of Aykut (2009). He found that European countries with high individualism and/or LTO cultures were more willing to adopt e-government than the countries with a collective culture and/or short-term orientation culture. Unfortunately, his study was limited to European countries only. There is evidence that people in countries with a LTO tend to have a longer vision and a more forward-thinking mentality (Hofstede, 2001). We conclude that it is this LTO that makes people more willing to take up e-government because they see it as their country's future, and they value the long-term benefits that e-government might bring to them. In terms of UA, our study found that there is a negative correlation between UA and e-government development. In this case the reason may be that people in low-uncertainly-avoidance cultures tend to take more risks and are more likely to embrace the uncertainty associated with implementing and adopting e-government.

Recent studies by Bélanger and Carter (2009) and the United Nations (2012) suggest that the variations in e-government development among nations are largely correlated to economic development. However, our empirical testing shows that economic status (measured by GDP per capita) is not a significant predictor of e-government development. There are good reasons to explain these different findings. Compared with other factors, namely, social, political, demographic and cultural factors and ICT infrastructure, economic factors may play only a secondary or indirect role in e-government development. In other words, economic wealth may not necessarily lead to high e-government development. For example, the e-government development index of the oil-rich countries with high GDP per capita in the Middle East region varies significantly with some countries being ranked higher (e.g. the United Arab Emirates being in 28th place and Bahrain in 36th) and the others significantly lower (e.g. Kuwait in 63th place and Oman in 64th place) in the most recent United Nations E-government Survey (United Nations, 2012). This phenomenon may reflect the multidimensional nature of e-government development where many factors are likely to come into play.

Contributions, implications, limitations, and future research

Theoretical contributions and implications

There exists a serious theoretical and operative challenge in the study of the effects of the digital divide on e-government development, given that there are many conceptualizations of the digital divide and some inconsistency in defining it in the extant literature. The study by Helbig *et al.* (2009) found that the current literature on each of the digital divide and e-government seems to run in parallel with relatively little interaction between the two. Our study has attempted to address this limitation. Specifically, our study makes three key theoretical contributions. First, we develop a multidimensional and integrative research model to study the digital divide and e-government development and the relationship between the two, and validate the model through systematically testing it with empirical data. Although many models have been developed to study the digital divide and e-government development separately,

the literature lacks analysis which employs a multidimensional and integrative approach (Luna-Reyes *et al.*, 2012). Second, our multidimensional and integrative model has enabled us better to understand how and why e-government development can be affected by the digital divide through a range of contextual factors. Thus, our model paves the way for the development of effective models to measure the digital divide and e-government development in a holistic way. As noted by Van Dijk (2006), Fuchs (2009), Helbig *et al.* (2009), and Bruno *et al.* (2010), current research lacks rigorous and adequate theoretical models to define and measure the complex and multidimensional nature of digital divide and e-government. Third, and contrary to prevailing understanding, the results of our study suggest that the economic status of a country does not reliably predict its level of digital divide and e-government development. In other words, although economic status appears to be important from a resource point of view, its significance wanes when political, social, cultural, and infrastructure factors all play a part. Further empirical study of this intriguing finding may lead to a theory capable of explaining the interplay among these variables.

Implications for practice

This study has significant practical implications. First, this study has demonstrated that the digital divide and e-government development are interrelated because they share the same dimensions and factors. This finding should help to inform public policy makers when developing strategies to deal with issues of the digital divide and e-government development by encouraging analysis in a holistic and integrative way. To enhance e-government development, any strategy needs to focus on tackling the digital divide. However, as found in this study, there are some variations in terms of the effects and the extent of the effects of the variables associated with the digital divide and e-government development. Therefore, simply addressing the digital divide alone is unlikely to be sufficient to stimulate an increase in the uptake of e-government. Second, the model we have developed and tested through this study allows both a country-based study to identify key areas for improvement and a cross-country study for benchmarking. For example, for a single country-based study, the model can be used to ascertain the most significant factors that encourage or hinder a country's e-government development. If the issue is one of government effectiveness, initiatives and endeavours by e-government providers may need to concentrate on the usefulness of e-government services such as the relevance and quality of government information, and online security. If it is a cultural issue, governments can improve their e-services by making them more engaging, interactive, and personal to address a country's or region's cultural norms. For a cross-country study (e.g. at the regional or international level), policy makers can use the data generated from our model to compare the performance of their country with others according to individual factors such as education, government, economy, and ICT infrastructure, and embrace relevant practices from other countries with similar cultures to bridge the digital divide and develop e-government. Third, our finding suggests that there is no simple direct relationship linking economic factors with the digital divide and e-government development. In other words, simply increasing investment in ICT projects may not directly lead to increasing the use of ICT and e-government diffusion. In this regard it appears that more needs to be done by governments in terms of education and training, and understanding and accommodating the behavioural character of its citizens and their cultural norms.

Limitations and future research

As often occurs when undertaking multi-nation analyses, the main limitation in this study was data availability. Our selection of variables and measures related to the digital divide and e-government was dependent on the availability of data as well as the authority, reliability, and currency of data sources. For example, we were not able to use the income inequality (GINI) index of the World Bank due to the lack of current data available on most countries. While this limited to some extent the depth and breadth of our study, we do not believe that it compromised the validity of our analysis.

Earlier published research suggested that citizens' attitudes may determine their use or non-use of the internet and e-government services (Warkentin *et al.*, 2002; Seyal and Pijpers, 2004; Carter and Bélanger, 2005; Van Dijk, 2006; Doong *et al.*, 2010). Fuchs (2009) called it "motivational access". For example, people who own or have access to computers and have the skills to use the internet and e-government services still may not do so because they do not see the relevance of, or do not trust in, government web sites. This psychological aspect of the digital divide is often neglected in digital divide literature (Fuchs, 2009; Bruno *et al.*, 2010). Although citizens' behavioural intention towards e-government services has been widely examined, it has been usually done by drawing on the concept of various technology acceptance models such as that of Davis *et al.* (1989) without sufficient attention being given to social, political, and cultural factors (Lean *et al.*, 2009). Due to the lack of relevant data for a global study, we could not test and verify the relationships between attitudinal variables and other contextual variables through this study. Future research is needed to incorporate attitudinal variables into a research model (e.g. Figure 1 in this paper), which may lead to a new theoretical account for how attitudinal variables interact with other variables.

Conclusion

As e-government reaches its maturity, the digital divide becomes a central issue in e-government development around the world according to the most recent survey report of the United Nations (2012). Our study makes an important and timely contribution to tackle the issue. The findings of our study highlight the important point that both the digital divide and e-government are complex, dynamic, and multifaceted phenomena. Therefore, if a full understanding of the digital divide or e-government development is desired, it is important not to attempt to explain the environment by restricting empirical studies to one or a limited number of factors. The multidimensional and integrative model that we developed and used in this study has demonstrated the feasibility and validity of conducting empirical studies in a holistic way.

References

- Ahmed, M. (2002), "First steps in implementation of Pakistan's National Database & Registration Authority", available at: www.egov4dev.org/success/case/nadra.shtml (accessed 10 August 2009).
- Al-Shafi, S. and Weerakkody, V. (2010), "Factors affecting e-government adoption in the state of Qatar", *European and Mediterranean Conference on Information Systems 2010 (EMCIS2010)*, pp. 1-23.
- Aykut, A. (2009), "Cross-cultural analysis of European e-government adoption", *World Applied Sciences Journal*, Vol. 7 No. 9, pp. 1124-1130.
- Bagchi, K. (2005), "Factors contributing to global digital divide: some empirical results", *Journal of Global Information Technology Management*, Vol. 8 No. 3, pp. 47-59.

-
- Barzilai-Nahon, K. (2006), "Gaps and bits: conceptualizing measurements for digital divide/s", *The Information Society*, Vol. 22 No. 5, pp. 269-278.
- Bélanger, F. and Carter, L. (2009), "The impact of the digital divide on e-government use", *Communications of the ACM*, Vol. 52 No. 4, pp. 132-135.
- Billon, M., Marco, R. and Lera-Lopez, F. (2009), "Disparities in ICT adoption: a multidimensional approach to study the cross-country digital divide", *Telecommunications Policy*, Vol. 33 Nos 10/11, pp. 596-610.
- Björn, N., Elena, G. and Ralf, P. (2012), "The digital divide vs the e-government divide: do socio-demographic variables (still) impact e-government use among onliners?", *Proceedings of ECIS 2012, Paper No. 199*, Barcelona, available at: <http://aisel.aisnet.org/ecis2012/199> (accessed 5 September 2012).
- Bruno, G., Esposito, E., Genovese, A. and Gwebu, L.K. (2010), "A critical analysis of current indexes for digital divide measurement", *The Information Society: An International Journal*, Vol. 27 No. 1, pp. 16-28.
- Carter, L. and Bélanger, F. (2005), "The utilization of e-government services: citizen trust, innovation and acceptance factors", *Information Systems Journal*, Vol. 15 No. 1, pp. 5-25.
- Central Intelligent Agency (2011), *CIA world Factbook*, Central Intelligent Agency, Washington, DC, available at: www.cia.gov/library/publications/the-world-factbook/fields/2011.html (accessed 15 June 2012).
- Chinn, M.D. and Fairlie, R.W. (2006), "ICT use in the developing world: an analysis of differences in computer and internet penetration", IZA Discussion Paper No. 2206, IZA, Bonn.
- Corrocher, N. and Ordanini, A. (2002), "Measuring the digital divide: a framework for the analysis of cross-country differences", *Journal of Information Technology*, Vol. 17 No. 1, pp. 9-19.
- Cruz-Jesus, F., Oliveira, T. and Bacao, F. (2012), "Digital divide across the European Union", *Information & Management*, Vol. 49 No. 6, pp. 278-291.
- Cuervo, M.R.V. and Menendez, L. (2006), "A multivariate framework for the analysis of the digital divide evidence for the European Union -15", *Information and Management*, Vol. 43 No. 4, pp. 56-766.
- Cullen, R. (2001), "Addressing the digital divide", *Online Information Review*, Vol. 25 No. 5, pp. 311-320.
- Davis, F.D., Bagozzi, R.P. and Warshaw, P.R. (1989), "User acceptance of computer technology: a comparison of two theoretical models", *Management Science*, Vol. 35 No. 2, pp. 982-1003.
- Dewan, S. and Riggins, F. (2005), "The digital divide: current and future research directions", *Journal of the Association for Information Systems*, Vol. 6 No. 12, pp. 298-337.
- Doney, P.M., Cannon, J.P. and Mullen, M.R. (1998), "Understanding the influence of national culture on the development of trust", *Academy of Management Review*, Vol. 23 No. 3, pp. 601-620.
- Doong, H., Wang, H. and Foxall, G.R. (2010), "Psychological traits and loyalty intentions towards e-government services", *International Journal of Information Management*, Vol. 30 No. 5, pp. 457-464.
- Dwyer, S., Mesak, H. and Hsu, M. (2005), "An exploratory examination of the influence of national culture on cross-national product diffusion", *Journal of International Marketing*, Vol. 13 No. 2, pp. 1-25.
- Erumban, A.A. and de Jong, S.B. (2006), "Cross-country differences in ICT adoption: a consequence of culture?", *Journal of World Business*, Vol. 41 No. 4, pp. 302-314.
- European Commission (2005), *The Impact of e-Government on Competitiveness, Growth and Jobs, IDABC e-Government Observatory, Background Research Paper*, European Commission, Brussels.

-
- European Commission (2006), *eGovernment Economics Project (eGEP): Economic Model Final Version*, European Commission, Brussels.
- Fishenden, J. and Thompson, M. (2012), "Digital government, open architecture, and innovation: why public sector IT will never be the same again", *Journal of Public Administration Research and Theory*, Vol. 23 No. 4, pp. 977-1004.
- Fuchs, C. (2009), "The role of income inequality in a multivariate cross-national analysis of the digital divide", *Social Science Computer Review*, Vol. 27 No. 1, pp. 41-58.
- Gant, J.P. (2008), *Electronic Government for Developing Countries*, International Telecommunication Union (ITU), Geneva.
- Gauld, R. and Goldfinch, S. (2006), *Dangerous Enthusiasms: E-government, Computer Failure and Information Systems Development*, University of Otago Press, Dunedin.
- Gefen, D., Rose, G., Warkentin, M. and Pavlou, P. (2006), "Cultural diversity and trust in IT adoption: a comparison of potential e-voters in the USA and South Africa", *Journal of Global Information Management*, Vol. 13 No. 1, pp. 54-78.
- Gil-García, J.R. and Pardo, T.A. (2005), "E-government success factors: mapping practical tools to theoretical foundations", *Government Information Quarterly*, Vol. 22 No. 2, pp. 187-216.
- Gouscos, D., Kalikakis, M., Legal, M. and Papadopoulou, S. (2007), "A general model of performance and quality for one-stop e-government service offerings", *Government Information Quarterly*, Vol. 24 No. 4, pp. 860-885.
- Grimmelikhuijsen, S. (2012), "Linking transparency, knowledge and citizen trust in government: an experiment", *International Review of Administrative Sciences*, Vol. 78 No. 1, pp. 50-73.
- Guijarro, L. (2007), "Interoperability frameworks and enterprise architectures in e-government initiatives in Europe and the United States", *Government Information Quarterly*, Vol. 24 No. 1, pp. 89-101.
- Guillen, M.F. and Suarez, S.L. (2005), "Explaining the global digital divide: economic, political and sociological drivers of cross-national Internet use", *Social Forces*, Vol. 84 No. 2, pp. 681-708.
- Hambleton, R. (2004), "Beyond new public management: city leadership, democratic renewal, and the politics of place", paper presented at the City Futures International Conference, Chicago, IL, available at: www.uic.edu/cuppa/cityfutures/papers/webpapers/cityfuturespapers/session8_1/8_1beyondnew.pdf (accessed 10 January 2012).
- Hargittai, E. (1999), "Waving the western web: explaining the differences in internet connectivity among OECD countries", *Telecommunications Policy*, Vol. 23, pp. 701-718.
- Heeks, R. (2006), *Implementing and Managing eGovernment: An International Text*, Sage, London.
- Heeks, R. and Bailur, S. (2006), "Analyzing e-government research: perspective, philosophies, theories, methods, and practice", Working Paper No. 16, Institute for Development Policy and Management, The University of Manchester, Manchester.
- Helbig, N., Gil-García, J.R. and Ferro, R. (2009), "Understanding the complexity of electronic government: implications from the digital divide literature", *Government Information Quarterly*, Vol. 26 No. 1, pp. 89-97.
- Hofstede, G. (2001), *Culture's Consequences: Comparing Values, Behaviors, Institutions and Organizations Across Nations*, Sage, Thousand Oaks, CA.
- House, R.J., Hanges, P.J., Javidan, M., Dorfman, P.W. and Gupta, V. (2004), *Culture, Leadership, and Organizations*, Sage, Thousand Oaks, CA.
- International Telecommunication Union (ITU) (2011), *Measuring the information society. Annual report of International Telecommunication Union*, ITU, Geneva.
- Kaylor, C. (2005), "The next wave of e-government: the challenges of data architecture", *Bulletin of the American Society for Information Science and Technology*, Vol. 31 No. 2, pp. 18-22.

- Khalil, O.E.M. (2011), "e-Government readiness: does national culture matter?", *Government Information Quarterly*, Vol. 28 No. 3, pp. 388-399.
- Kiiski, S. and Pohjola, M. (2002), "Cross-country diffusion of the internet", *Information Economics and Policy*, Vol. 14 No. 2, pp. 297-310.
- Kovačić, Z. (2005), "The impact of national culture on worldwide e-government readiness", *Informing Science*, Vol. 8, pp. 143-158.
- Kumar, V., Murkerji, B., Butt, I. and Persaud, A. (2007), "Factors for successful e-government adoption: a conceptual framework", *The Electronic Journal of E-Government*, Vol. 5 No. 1, pp. 63-76.
- Lean, O.K., Zailani, S., Ramayah, T. and Fernando, Y. (2009), "Factors influencing intention to use e-government services among citizens in Malaysia", *International Journal of Information Management*, Vol. 29 No. 6, pp. 458-475.
- Liu, M.C. and San, G. (2006), "Social learning and digital divides: a case study of internet technology diffusion", *Kyklos*, Vol. 59 No. 2, pp. 307-321.
- Luna-Reyes, L.F., Gil-Garcia, J.R. and Romero, G. (2012), "Towards a multidimensional model for evaluating electronic government: proposing a more comprehensive and integrative perspective", *Government Information Quarterly*, Vol. 29 No. 3, pp. 324-334.
- Metaxiotis, K. and Psarras, J. (2004), "E-government: new concept, big challenge, success stories", *Electronic Government: An International Journal*, Vol. 1 No. 2, pp. 141-151.
- Mossberger, K., Tolbert, C.J. and Gilbert, M. (2006), "Race, place, and information technology", *Urban Affairs Review*, Vol. 41 No. 5, pp. 583-620.
- Mossberger, K., Tolbert, C. and Stansbury, M. (2003), *Virtual Inequality: Beyond the Digital Divide*, Georgetown University Press, Washington, DC.
- Norris, P. (2001), *Digital Divide: Civic Engagement, Information Poverty and the Internet Worldwide*, Cambridge University Press, New York, NY.
- OECD (2001), *Understanding the Digital Divide*, OECD, Paris.
- Olivier, K.T. (2002), The Cameroon Government web portal, available at: www.egov4dev.org/success/case/camportal.shtml (accessed 10 August 2009).
- Reece, B. (2006), "E-government literature review", *Journal of E-Government*, Vol. 3 No. 1, pp. 69-110.
- Sciadas, G. (2002), *Monitoring the Digital Divide*, Orbicom, Montreal.
- Scholl, H. (2001), *Applying Stakeholder Theory to e-Government: Benefits and Limits*, New York Centre for Technology in Government, University of Albany, Albany, NY.
- Seyal, A.H. and Pijpers, G.G. (2004), "Senior government executives' use of the internet: a Bruneian scenario", *Behaviour & Information Technology*, Vol. 23 No. 3, pp. 197-210.
- Srite, M. and Karahanna, E. (2006), "The role of espoused national cultural values in technology acceptance", *MIS Quarterly*, Vol. 30 No. 3, pp. 679-704.
- Thomas, J.C. and Streib, G. (2003), "The new face of government: citizen-initiated contacts in the era of e-government", *Journal of Public Administration Research and Theory*, Vol. 13 No. 1, pp. 83-102.
- Tifferet, S. and Herstein, R. (2010), "The effect of individualism on private brand perception: a cross-cultural investigation", *Journal of Consumer Marketing*, Vol. 27 No. 4, pp. 313-323.
- Tolbert, C.J. and Mossberger, K. (2006), "The effects of e-government on trust and confidence in government", *Public Administration Review*, Vol. 66 No. 3, pp. 354-369.
- United Nations (2012), *United Nations e-Government Survey 2012: E-Government for the People*, United Nations, New York, NY.
- Van Dijk, J. (2006), "Digital divide research, achievements, and shortcomings", *Poetics*, Vol. 34 No. 4, pp. 221-235.

- Van Dijk, J. and Hacker, K. (2003), "The digital divide as a complex and dynamic phenomenon", *The Information Society*, Vol. 19 No. 4, pp. 315-356.
- Vehovar, V., Sicherl, P., Hüsing, T. and Dolnicar, V. (2006), "Methodological challenges of digital divide measurements", *The Information Society*, Vol. 22 No. 5, pp. 279-290.
- Vicente, M.R. and López, A.J. (2006), "A multivariate framework for the analysis of the digital divide: evidence for the European Union-15", *Information & Management*, Vol. 43 No. 6, pp. 756-766.
- Warkentin, M., Gefen, D., Pavlou, P. and Rose, G. (2002), "Encouraging citizen adoption of e-government by building trust", *Electronic Markets*, Vol. 12 No. 3, pp. 157-162.
- Wei, K.-K. (2011), "Conceptualizing and testing a social cognitive model of the digital divide", *Information Systems Research*, Vol. 22 No. 1, pp. 170-187.
- Welch, E.W., Hinnant, C.C. and Moon, M.J. (2005), "Linking citizen satisfaction with e-government and trust in government", *Journal of Public Administration Research and Theory*, Vol. 15 No. 3, pp. 371-391.
- World Bank (2008), "Definition of e-government", available at: <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/EXTEGOVERNMENT/0,,contentMDK:20507153~menuPK:702592~pagePK:148956~piPK:216618~theSitePK:702586,00.html> (accessed 15 May 2009).
- World Bank (2011), "The Worldwide Governance Indicators (WGI)", available at: <http://info.worldbank.org/governance/wgi/index.asp> (accessed 15 June 2012).
- World Bank (2012), "Indicators", available at: <http://data.worldbank.org/indicator/> (accessed 15 June 2012).
- Yildiz, M. (2007), "Government research: reviewing the literature, limitations, and ways forward", *Government Information Quarterly*, Vol. 24 No. 3, pp. 646-665.
- Zhang, X. and Maruping, L.M. (2008), "Household technology adoption in a global marketplace: incorporating the role of espoused cultural values", *Information Systems Frontiers*, Vol. 10 No. 4, pp. 403-413.
- Zhao, F. (2013), "An empirical study of cultural dimensions and e-government development - Implications of the findings and strategies", *Behaviour and Information Technology*, Vol. 32 No. 3, pp. 294-306.
- Zhao, F., Scavarda, A. and Waxin, F.M. (2012), "Key issues and challenges in e-government development: an integrative case study of the number one e-City in the Arab world", *Information Technology & People*, Vol. 25 No. 4, pp. 295-422.
- Zheng, Y. and Walsham, G. (2008), "Inequality of what? Social exclusion in the e-society as capability deprivation", *Information Technology & People*, Vol. 21 No. 3, pp. 222-243.

Further reading

- Carter, L. and Weerakkody, V. (2008), "E-government adoption: a cultural comparison", *Information Systems Frontiers*, Vol. 10 No. 4, pp. 473-482.
- Cohen, J., Cohen, P., West, S.G. and Aiken, L.S. (2003), *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*, Lawrence Erlbaum Associates, Mahwah, NJ.
- Gupta, M.P. and Jana, D. (2003), "E-government evaluation: a framework and case study", *Government Information Quarterly*, Vol. 20 No. 4, pp. 365-387.
- Olaya, D. (2010), *Gender and ICT*, World Summit on the Information Society Forum, Geneva, available at: www.itu.int/ITU-D/ict/papers/2010/PresentationGender-WSIS.pdf (accessed 29 April 2011).
- Pinch, T.J. and Bijker, W.E. (1984), "The social construction of facts and artifacts: or how the sociology of science and the sociology of technology might benefit each other", *Social Studies of Science*, Vol. 14 No. 3, pp. 399-441.

Model	Coefficients ^{a,b,c,d}				Sig.	Collinearity statistics	
	Unstandardized coefficients <i>B</i>	SE	Standardized coefficients β	<i>t</i>		Tolerance	VIF
<i>Digital divide</i>							
(Constant)	-27.082	9.515		-2.846	0.005		
Education	15.923	5.886	0.107	2.705	0.008	0.453	2.206
Gender ratio	11.010	3.795	0.094	2.902	0.004	0.679	1.473
Age	0.395	0.171	0.088	2.314	0.022	0.496	2.017
GDP per capita	0.005	0.000	0.013	0.243	0.808	0.254	3.936
Govt. Effectiveness	8.701	2.094	0.299	4.155	0.000	0.138	7.259
Corruption Control	-0.950	1.849	-0.034	-0.514	0.608	0.167	5.986
Broadband	0.731	0.172	0.323	4.254	0.000	0.124	8.063
Internet access	0.767	0.161	0.327	4.770	0.000	0.152	6.581
Server	0.003	0.002	0.099	1.957	0.052	0.282	3.546
<i>e-government development</i>							
(Constant)	0.014	0.060		0.242	0.809		
Education	0.344	0.037	0.322	9.336	0.000	0.434	2.306
Gender ratio	0.011	0.024	0.013	0.448	0.655	0.645	1.550
Age	0.002	0.001	0.067	2.048	0.042	0.480	2.084
GDP per capita	0.007	0.000	0.040	0.894	0.373	0.254	3.938
Govt. Effectiveness	0.067	0.013	0.319	4.953	0.000	0.124	8.037
Corruption Control	-0.029	0.011	-0.142	-2.559	0.011	0.167	5.995
Broadband	0.002	0.001	0.120	1.764	0.080	0.111	8.969
Internet access	0.002	0.001	0.106	1.712	0.089	0.133	7.511
Server	0.005	0.000	-0.070	-1.618	0.108	0.275	3.630
Internet use	0.002	0.000	0.306	4.577	0.000	0.115	8.691
<i>e-government development and culture</i>							
(Constant)	0.399	0.109		3.673	0.000		
Power distance	-0.001	0.001	-0.172	-1.506	0.136	0.550	1.820
Uncertainty avoidance	0.002	0.001	-0.182	2.110	0.038	0.964	1.037
Individualism	0.005	0.001	0.561	4.909	0.000	0.549	1.821
Masculinity	-0.001	0.001	-0.097	-1.091	0.279	0.909	1.101
Long-term orientation	0.002	0.001	0.235	2.763	0.007	0.988	1.012
<i>Digital divide and culture</i>							
(Constant)	15.846	16.321		0.971	0.335		
Power distance	-0.178	0.147	-0.138	-1.212	0.230	0.550	1.820
Uncertainty avoidance	0.130	0.110	-0.102	1.181	0.242	0.964	1.037
Individualism	0.748	0.140	0.611	5.347	0.000	0.549	1.821
Masculinity	-0.067	0.135	-0.044	-0.496	0.622	0.909	1.101
Long-term orientation	0.208	0.111	0.159	1.868	0.066	0.988	1.012

Table AI.
SPSS output of
standard multiple
regression analysis

Notes: ^aDependent variable: internet use; ^bdependent variable: e-government development; ^cdependent variable: e-government development; ^ddependent variable: internet use

Corresponding author

Dr Fang Zhao can be contacted at: fzhao@aus.edu

To purchase reprints of this article please e-mail: reprints@emeraldinsight.com
Or visit our web site for further details: www.emeraldinsight.com/reprints