The effects of infrastructure and policy on e-business in Latin America and Sub-Saharan Africa

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Abstract
This study investigates experts' assessments of the pertinent factors affecting e-business in developing countries from a theory-based national infrastructure perspective. We surveyed experts (business people, academicians, and officials of governmental and non-governmental organizations) in e-business in Latin America (LA) and Sub-Saharan Africa (SSA). Our partial least squares analysis shows that experts believed that policies targeted specifically toward e-business are important in affecting e-business capabilities and in obtaining value from e-business, more so than non-specific general information and communication technologies (ICT) policies, which are not significantly influential. ICT infrastructure generally affects e-business capabilities, though this was not found to be the case in Brazil. Experts believed that national government institutions positively affect e-business value in SSA, but not in LA. Experts did not believe that commercial infrastructure significantly affects e-business value. This study theoretically and empirically distinguishes between two different dimensions of e-business outcomes: specific capabilities and value derived from e-business. It operationalizes the effects of national government institutions and commercial infrastructure on e-business outcomes and empirically tests for their effects. The study provides empirical support for conceptual arguments for the need of ICT policies specific to the needs of e-business.
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Introduction

> In many cases e-business would be [the] first choice for SMEs, but the infrastructure does not exist to support it – even where ICTs are available, there may not be power, education, payment systems, markets or water, and these are all essential ingredients for the 'business' part of 'e-business'.
> Respondent to our e-business survey in Sub-Saharan Africa

Arguing for the paramount importance of electronic business diffusion as a major impetus for socioeconomic development in developing countries, Kofi Annan, the then Secretary General of the United Nations stated that 'e-commerce is one of the most visible examples of the way in which information and communication technologies (ICT) can contribute to economic growth' (UNCTAD, 2002). However, Petrazzini and Kibati (1999, p. 31) noted that 'a closer look reveals great disparities between high- and low-income regions in terms of both Internet hosts and users. More than 97% of all Internet hosts are in developed countries that are

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home to only 16% of the world's population'. Such disparities – which unfortunately continue to date – highlight the need to focus attention on the low-income regions of the world (Jarvenpaa and Leidner, 1998; Madon, 2005; Boateng *et al.*, 2009; Hinson *et al.*, 2009).

E-business – business transactions or processes using the Internet – is just one dimension of the benefits that the Internet can bring to developing countries in general (MacKay *et al.*, 2004) as well as to small and medium enterprises (SMEs) within these countries in particular (Brown and Lockett, 2004). E-business stands out in that it generates income from economic activities for citizens of a developing country who are engaged in commercial enterprises (Meso *et al.*, 2005; Hinson *et al.*, 2009). Moreover, it provides employment and generates government revenues in taxes. E-business has the potential to be self-propagating and self-sustaining, the holy grail of development researchers and organizations on their quest for sustainable development. By fostering internal and external trade, e-business might create and attract wealth that could be used to develop much-needed structural infrastructure such as roads, telecommunication networks, dams, as well as social infrastructure, such as hospitals and schools.

However, there has been little quantitative research that focuses on factors that contribute toward effective e-business in developing countries. Furthermore, there is no known study that has taken a comprehensive, broad-based approach to investigate e-business in the Sub-Saharan Africa (SSA) and Latin American regions, nor do we know of any study that has compared the two. Such a focus is fundamental to advancing the body of knowledge on technology diffusion in developing nations, as these regions are regarded as an untapped market to which many developed nations are extending their business bases.

In this study, we develop theoretical models that identify various pertinent factors from the perspective of infrastructure, and we hypothesize several interrelationships to determine e-business outcomes in developing countries. We particularly focus on business-to-business e-business, as there is no meaningful degree of business-to-consumer e-business at this time – at least, not with citizens in developing countries as the consumers. To verify the factors identified in our literature review that are pertinent to e-business in developing countries, we conducted a quantitative, broad-based survey of relevant experts and decision makers. We use the partial least squares (PLS) methodology of structural equation modeling to test our model.

In a report on global e-commerce, the United Nations Conference on Trade and Development identified infrastructure that operates at the national level, such as the national ICT infrastructure and the government's attitudes and policies toward ICTs and e-business (UNCTAD, 2002). In that report, as highlighted above, the United Nations Secretary-General directly linked e-business with economic development, a national-level construct.

Indeed, the most fundamental motivation for this study is identifying e-business as a means for increasing economic development in developing countries. Most development research and studies of ICT diffusion in the information systems literature operate on this level (Nambisan *et al.*, 1999). From these studies and from our own empirical investigation, we want to learn what this level of analysis can tell us about e-business in developing countries. Specifically, we seek to answer the following research question:

What kinds of national infrastructure contribute toward effective e-business outcomes in developing countries?

Theoretical background
Overall, current models of ICT transfer within developed countries assume an existing (usually sound) national infrastructure on which e-business can be built. This is far from the reality in many developing countries such as those in SSA and Latin America (LA) and remains a major bottleneck to e-business transfer within these regions. Although some e-business implementations have succeeded in these regions in spite of the prevailing poor national infrastructure, they have mainly been limited to large multinationals. This continues to be a major concern, given that SMEs could particularly benefit from e-business to reach markets well beyond their current geographical boundaries.

Information systems research has produced many frameworks that examine different dimensions of factors necessary to support e-business (Fichman, 2000; Brown and Lockett, 2004; Otim and Grover, 2006; Zhu *et al.*, 2006). This research covers e-business applications, technological issues, support and implementation, and many other aspects. In addition, theories on technology and innovation transfer, adoption, and diffusion have emerged that are helpful in understanding how ICTs can spread in a country (Dutta, 1997; Montealegre, 1999; Wolcott *et al.*, 2001; Travica, 2002; Mbarika *et al.*, 2007a, b; Kifle *et al.*, 2008; Sood *et al.*, 2008). | Q5

The Arab policy and IT (APIT) model
There has also been an increasing amount of literature on the factors that affect development of the Internet and e-business in developing countries. In the midst of this breadth of research, one notable stream has been the research produced by the APIT project (Straub, 2005). This project is based on a research model of information technology transfer (ITT) that has spawned a large stream of research, which investigates various aspects of ICT outcomes in developing countries in general, and in Arab nations in particular (Hill *et al.*, 1994; Hill *et al.*, 1998; Rose and Straub, 1998; Loch *et al.*, 2000b; Straub *et al.*, 2001; Checchi *et al.*, 2002; Straub *et al.*, 2002; Meso *et al.*, 2003). | Q6

The primary goals of the APIT model is to answer the questions: '(1) How do national information technology (IT) policies affect ITT? (2) Which transfer implementation factors affect ITT?' (Loch *et al.*, 2000a). In the model, National ICT Policies positively influence ITT/ICT

outcomes. Transfer Implementation Factors also influence ITT/ICT outcomes, but the effect might be positive or negative, depending on the specific factor. We discuss each of these constructs in greater depth below.

While APIT is the closest available model that attempts to comprehensively explain the policy and infrastructure factors that affect developing countries, it does not address the particular factors that affect the development and success of e-business. To fill this gap in the literature, we developed a model that builds upon and extends APIT with three predictor constructs that we postulate directly affect e-business outcomes. *ICT policies* have two dimensions: *general ICT policies* and *e-business policies*. We propose that *ICT infrastructure* is unidimensional, whereas the *institutional and commercial environment* has two dimensions: *institutions* and *commercial infrastructure*. In addition to their direct effect on e-business outcomes, we postulate that both ICT policies dimensions have a direct effect on ICT infrastructure. In the sections that follow, we discuss in detail how we came up with this model and respective constructs. Furthermore, in Figure 1 we present the national level model with all the postulated paths labeled with the specific hypotheses that we offer.

### E-business outcomes as the dependent variable: capabilities and value

There are two general aspects to evaluating e-business, particularly from an empirical perspective. First, many studies examine the actual applications and functionality of e-business, that is the *capabilities* that e-business enables, such as providing product information, interactive websites, online transactions, etc. (Dekleva, 2000; Daniel and Hugh, 2003). One of the challenges in harnessing the potential of e-business has involved understanding how best to measure it in order to maximize its benefits. A second aspect of evaluating e-business involves assessing whether it delivers its promised benefits; that is, if it

provides *value* to the businesses that employ it (Boon *et al.*, 1994; Kardaras and Karakostas, 2001; Kirkman *et al.*, 2002; Otim and Grover, 2006). Value, or the success of e-business, can be evaluated in terms of increases in sales, profits, or customers. It can also be seen from the perspectives of saving costs, increasing process efficiency, saving time, and reducing personnel requirements.

Although e-business capabilities and e-business value are closely related, we believe they are sufficiently distinct that a factor might have different effects on these two dimensions of e-business outcomes. For all the constructs in our models, we postulate their effects on each of the two dimensions of e-business outcomes. Although we have pointed out that the effects might be different on the capabilities and value dimensions of e-business, we hypothesize that, in every case, they will move in the same direction; that is, either both positive or both negative. One of the contributions of this study is to explicitly make this distinction in a single theoretical model.

However, although we believe these factors to be distinct, they are very likely to be strongly related to each other. In particular, it is the capabilities of e-business that allow it to give value in a business context. While the converse – that greater value derived from e-business would increase the capabilities that are implemented due to greater appreciation of its benefits – could also be claimed, it does not necessarily follow that managers would automatically increase their capabilities as a result of greater value derived. Thus, we hypothesize a direct relationship in the direction of capabilities toward value (Zhu and Kraemer, 2002; Okoli and Mbarika, 2003).

H1: *The capabilities of e-business are positively related to valuable e-business outcomes.*
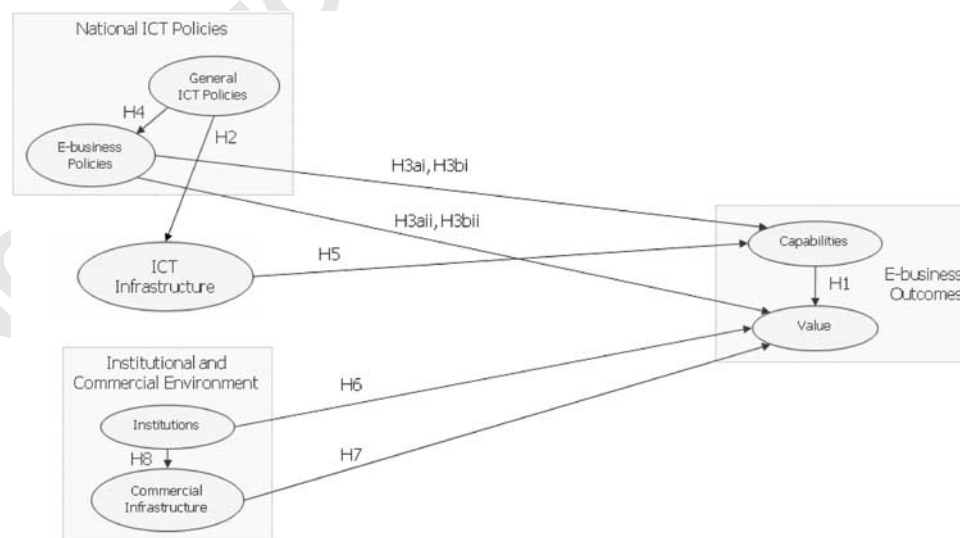
Figure 1 National infrastructure model of e-business outcomes.

ICT policies

ICT policies refer to the 'specific technology policies that guide the development of information systems in a specific country', indicating 'the level of support for technological development' (Loch *et al*., 2000a, b). ICT policies are a widely recognized factor that affects both the diffusion of computers and the intensity of tele-communications. There are many policy issues that affect the diffusion of ICTs in general and e-business in particular (Kraemer *et al*., 1992; Kamel, 1995; Madon, 2005; Mekonnen & Sahay, 2008). In the APIT model, 'National ICT Policies' refer to what we term in this paper 'general ICT policies', which have to do with ICTs in general, without particular regard to the unique needs of e-business (Loch *et al*., 2000a). We will treat each factor in more detail below.

General ICT policies   Various studies have examined the effects of ICT policy on the development of ICT infrastructure. Madon (2005) and Mekonnen & Sahay (2008) show how policy issues impact ICT transfer in India and Ethiopia, respectively. King *et al*. (1994) frame ICT policies in terms of how national institutions either influence or regulate the demand or supply of ICTs and technology innovation. They argue that these institutional effects occur through acts of knowledge building, knowledge deployment, subsidies, mobilization, standard setting, and innovation directives. Montealegre (1999) found that ICT policies were significant in ICT development in four Latin American countries, and Raman and Yap (1996) found the same to be true in Malaysia. Numerous other studies, both empirical and conceptual, have also confirmed the effects (Gurbaxani *et al*., 1990; King *et al*., 1994; Tractinsky and Jarvenpaa, 1995; Raman and Yap, 1996; Dutta, 2001). These studies, as does the APIT model (Checchi *et al*., 2002), generally indicate that policies that favor the development of ICTs help the growth of national ICT infrastructures.

H2:   *General ICT policies are positively related to the level of ICT infrastructure.*

E-business policies   The literature on e-business policy is relatively new and thus sparse. However, a few studies have examined the effects of ICT policy that focuses on issues peculiar to e-business, such as those concerning digital signatures and intellectual property rights for digital products (Jarvenpaa and Tiller, 1999; Kardaras and Karakostas, 2001). Jarvenpaa and Tiller (1999) call on managers to align their e-business strategies with the policy environments in which they find themselves, as such strategic alignment is critical for effective e-business outcomes. Checchi *et al*. (2002) found that the Egyptian government has implemented a few policies specifically focused on e-business, including encouraging e-commerce activity within the government itself, and supporting the e-business legal framework by enacting laws concerning

copyrights, digital signatures, and digital certificates. Similarly, the government of Turkey enacted specific ICT policies and strategies to promote ICT interventions such as e-government (Kahraman *et al*., 2007). Although the APIT model only specified 'national ICT policies', the studies we have cited here indicate that such targeted policies are necessary for effective e-business outcomes, over and above the effects of more general ICT policy. Although examples of specific e-business policies are rare, the link between them and e-business outcomes will be tested.

However, it is unlikely that a country would implement policies specific to e-business without having a larger national framework of general ICT policies. In fact, specific e-business policies emerge from a larger context of a broader ICT strategy. This would suggest a direct relationship between general ICT policies and specific e-business policies (Lishan, 1996; Mbarika, 2001; Okoli and Mbarika, 2003). However, there is no theoretical evidence for a direct effect on e-business policies and national ICT infrastructure.

H3ai: *E-business policies are positively related to the capabilities of e-business.*

H3aii: *E-business policies are positively related to valuable e-business outcomes.*

H3bi: *E-business policies are more positively related to the capabilities of e-business than are general ICT policies.*

H3bii: *E-business policies are more positively related to valuable e-business outcomes than are general ICT policies.*

H4:   *General ICT policies are positively related to e-business policies.*

ICT infrastructure

To enable the use of the Internet, developing countries need solid telecommunication infrastructures (for a review, see, Mbarika *et al*., 2001; Kaba *et al*., 2008). In fact, poor infrastructure has been postulated as an impediment to software development and implementations in even the more advanced African countries (Mursu *et al*., 2003). Following McLoughlin (2000, p. 2), an ICT infrastructure is defined as a 'physical system of telecommunications pathways and connections that transmit voice, video, and data, and encompassing a web of telecommunications, information, and computing technologies'.

The APIT model specifies 'ITT/ICT Outcomes' as the main outcome variable of ICT policies (Checchi *et al*., 2002); in this study we use the more common term, 'ICT infrastructure'. However, there has been a considerable amount of research arguing that ICT infrastructure is a necessary prerequisite for effective e-business outcomes (Kardaras and Karakostas, 2001), specifically defined in terms of e-business capabilities. Other research has

argued more generally about the effects of ICT infrastructure on economic development (Odedra-Straub, 1993; Raman and Yap, 1996; Dutta, 1997). We could argue, in the context of this present study, that this relationship is at least partially mediated by e-business capabilities. However, we have no basis to expect that ICT infrastructure would be directly related to the value derived from e-business, other than through its indirect effect on capabilities.

H5: *Higher quality ICT infrastructure is positively related to the capabilities of e-business.*

Institutional and commercial environment

Institutional theories are helpful in understanding how the Internet and e-business might become successful in developing countries. King *et al*. (1994) frame ICT policies in terms of how national institutions either influence or regulate the demand or supply of ICTs and technology innovation. They argue that these institutional effects occur through acts of knowledge building, knowledge deployment, subsidies, mobilization, standard setting, and innovation directives. Their framework explains how governments, academic institutions, industry consortiums, international development organizations, and other institutions that affect a large number of organizations are very important in affecting the diffusion of IT at regional and national levels. Montealegre's (1999) empirical investigation of the temporal institutional factors that have contributed to the development of Internet infrastructure in four Latin American countries identifies specific institutional actors. He found that governmental agencies, academic institutions, private institutions, telecommunication providers, and international institutions all served important roles in advancing ICT adoption in these countries. In this study, we distinguish two kinds of institutions that operate at the national level, and that would affect e-business outcomes in developing countries: government institutions and commercial infrastructure.

Government institutions The government institutions factor refers to the effectiveness of the government that lays a background for all kinds of social interactions, including business using the Internet. Some studies in development economics measure the quality of institutions in terms of factors such as government regulation and bureaucracy, the rule of law, and corruption and graft (Sachs and Warner 1997; Easterly and Levine, 2002). Although the institutional environment is recognized as an important factor in economic performance in general, as well as in the ICT literature (King *et al*., 1994; Kahraman *et al*., 2007), it has not been a common factor in the e-business literature. Though developing countries might enact far-reaching ICT and e-business policies, strong government institutions are necessary to implement visionary policies; otherwise they amount to

little more than ineffectual politicking. While there is no particular reason to believe that effective institutions would affect the specific capabilities of e-business, we expect that they would enable enterprises to derive value from their e-business ventures.

H6: *More functional and stable national government institutions are positively related to valuable e-business outcomes.*

Commercial infrastructure

The commercial infrastructure refers specifically to those aspects of the institutional environment that provide support for businesses to continue effectively. Few frameworks that model e-business and ICTs are specifically tailored to a developing country context. Developing countries face a number of unique issues that are not major factors in the developed countries where most theories of e-business and IT diffusion are set (Bingi *et al*., 2000; Travica, 2002; Sood *et al*., 2008). In his study of e-business diffusion in Costa Rica, Travica (2002) explicitly incorporates many important factors taken for granted by the other frameworks, such as infrastructure for physical transportation of goods and consumer culture pertinent to e-business. One of the primary endogenous factors that affects a nation's commercial infrastructure is the quality and stability of its governmental institutions (LeBlanc *et al*., 2004). We expect commercial institutions to have similar effects on e-business: they would not necessarily affect the specific capabilities of e-business, but should enable enterprises to derive value from their e-business ventures.

H7: *Higher quality commercial infrastructure is positively related to valuable e-business outcomes.*

H8: *More functional and stable national government institutions have a positive effect on the quality of commercial infrastructure.*

Methodology

In this study we present a theoretical model of e-business in developing countries. We use a questionnaire-based survey to solicit subjective, perceptual responses from relevant experts. An expert is an individual who has acquired knowledge in a specific domain gradually through a period of learning and experience (Turban, 1995), which in turn shapes the person's cognitive, judgmental, social, creative, analytical, and procedural behavior over time (Greenwell, 1988). Although we do not survey the actual users of e-business in SSA, many of our experts – particularly the practitioners – *are* actual users. Most of the practitioners in our study are managers and corporate executives – we have very few members of other classes of experts. We recognize that those who actually use the e-business systems that others

have ordered and implemented might have different perspectives on their capabilities and value. However, at the present stage of e-business in SSA and LA, it is not feasible to identify and contact a statistically meaningful sample of organizations that use e-business to get a representative user perspective. We believe that the assessments of managers are an acceptable substitute at this stage in development.

A number of studies in information systems and developmental economics research have taken a somewhat similar approach in soliciting answers from experts (or 'professionals' or 'stakeholders') about the behavior of organizations (Ngai and Wat, 2002; Dickinger *et al.*, 2008), and in some cases have employed experts at the development stage of the research instrument (Zhu *et al.*, 2006). We identified four relevant categories of experts who would have important and valuable knowledge about e-business in developing countries: practitioners, government officials, officials of non-governmental organizations (NGOs), and academics. In addition to previous scientifically researched studies that have used experts to assess a given phenomenon (Ngai and Wat, 2002; Kifle *et al.*, 2008), these experts (stakeholders) have also been identified by the United Nations Economic Community for Africa as fundamental in defining policy directions for SSA countries (UNECA, 1999a). As we did not find any separate recommendations on expert categories particularly relevant to LA, we used the same categories for both regions.

Scope of the study: urban SMEs in LA and SSA
In order to focus and obtain meaningful results, we restricted the scope of our study in a number of important ways. First, we have chosen to focus on LA and SSA. They are two of the regions that have less prior research focused on e-business and, we believe, are in greatest need. In this study, 'Latin America' refers to all Spanish- and Portuguese-speaking countries of North America, South America, Central America, and the Caribbean. 'Sub-Saharan Africa' refers to all countries in Africa except the five countries of North Africa, which are more socioeconomically similar to the Middle East, and except the Republic of South Africa, which, although a part of SSA, is very different economically from the rest of SSA.

Second, we restricted the scope of this study to urban centers. On the one hand, because of the very limited current activity in rural areas of many developing countries, it is simply not feasible at this time to conduct an empirical study that would include this important sector. On the other hand, it would be grossly inaccurate to assume that the state of e-business in developing countries would be the same in rural areas as it is in urban areas.

Third, we focus only on SMEs because we expect that many, if not most, large businesses in developing countries that presently implement e-business are local branches of multinational companies, a concern that was confirmed in informal interviews with some of our expert

respondents. Furthermore, there might be such large disparities between the e-business use of SMEs and large businesses that it might be difficult to accurately interpret the results. Several studies have adopted such a focus on SMEs to yield results with more trustworthy inferences (Brown and Lockett, 2004; Gengatharen and Standing, 2005). To sum up, we asked the experts to respond only about *urban SMEs in their respective countries*.

Instrument creation
We administered the questionnaires using the World Wide Web, paper, and electronic document versions and distributed the questionnaires to respondents via the World Wide Web, regular postal mail, and e-mail, respectively. Borrowing from and adapting items used in the studies in our literature review, we developed multiple-item measures for each item.

The various studies in the *Information Systems Research* 2002 double special issue on e-commerce metrics (June and September) provide measurements for organizational-level measurement of e-business. For policy issues specifically related to e-business, we looked to a particular subset of policy-focused studies that have discussed specific issues or even developed empirical measures and instruments for gauging the effects of ICT policies on e-business outcomes (King *et al.*, 1994; Jarvenpaa and Tiller, 1999; Montealegre, 1999). For measuring ICT infrastructure, we drew from instruments that measure different aspects of ICT infrastructure at the national level, including aspects such as teledensity (per capita telephone lines) (Mbarika, 2001), telecommunications infrastructure (Dutta, 1997), and e-readiness assessments of ICT infrastructure (Wolcott *et al.*, 2001). To conceptualize institutional factors for our study, we drew primarily from the economic development literature that provided aspects such as governmental effectiveness, corruption, and regulatory burden to businesses, with some reference to ICT strategy and planning (Sachs and Warner, 1997). For commercial infrastructure, we drew from an eclectic set of sources comprising economic development (Bingi *et al.*, 2000; Eze, 2002; Travica, 2002), IS research (Chin *et al.*, 1996), and e-readiness assessments (APEC, 1999).

In accordance with our particular focus on urban SMEs in LA and SSA, we very specifically asked for these restrictions in our answers. For example, in measuring e-business value, we asked, 'Please indicate how much you agree or disagree with these statements about the impacts of e-business in the context of urban SME businesses [sic] in your country'. We had asked participants earlier to specify a response country, and we used the redundant phrase 'SME business' to further emphasize our focus.

Pilot study
We conducted a pilot study on just SSA experts in order to validate the instrument that we would use for the main studies, and to test the administrative procedure of our

study to ensure that it was appropriate for gathering adequate data. Out of 399 contacts in SSA (obtained from the data set described in the main study administration below), we obtained 48 usable responses. Next, we analyzed the results based on Cronbach's α and exploratory factor analysis, on confirmatory factor analysis and discriminant validity tests, and on examining the respondents' feedback on the initial instrument. Then we revised and expanded the instrument for this present study from 25 questions to 34 final, improved questions for the national infrastructure part of the study. Finally, we used this final validated instrument to conduct the main study in both SSA and LA.

Survey administration

For the SSA data, we used two databases of experts in African ICTs. First, we obtained contacts from a database of over a thousand organizations from the African Information Society Initiative (AISI), a project sponsored by the United Nations Economic Commission for Africa. We used 399 of these contacts for our pilot study. Our second African data source was the database of experts provided by the African Research for Information Society Emergence (ARISE), a project sponsored by the International Development Research Centre of Canada. For SSA, we administered the survey in English.

For our LA contacts, we obtained contacts from a number of different sources: FUNDRES, an NGO focusing on ICT issues in developing countries; the Institute for Connectivity for the Americas (Ottawa, Canada); Camara-e: the Brazilian Chamber of e-commerce (São Paulo, Brazil); and *Connectivity-World* (London, U.K.), an international ICT magazine focused on developing countries. For LA, we administered the survey in Spanish, Brazilian Portuguese, and English.

As SSA contacts, we used the 896 AISI contacts left after conducting the pilot study and all the contact from the ARISE database, totaling 1092 experts. We received 158 completed responses. One hundred and ninety-five e-mails or physical letters were returned undeliverable. Thirty-nine respondents asked to be excluded from the survey. This gave an effective response rate of 22% ([158 + 39]/[1092 − 195]). After removing responses with excessive missing data, and removing all respondents who indicated less than 1 year of expertise in e-business, we had 138 usable responses. For LA, we received a total of 198 completed responses. Unfortunately, our contact list sources for LA were unwilling or unable to provide figures about the numbers of their contacts, so we were unable to calculate response rates for these contact attempts. After similarly cleaning the data, and eliminating respondents with less than a year of expertise, we were left with 178 usable responses. Thus, for our analysis, we had 316 total responses (138 from SSA, and 178 from LA).

Out of 178 Latin American responses, experts responded from 14 countries in Central America (including 6 from Mexico), 4 from the Caribbean, 56 from South America

excluding (excluding Brazil), 98 from Brazil, and 6 responded generally, for all of LA. Of the 138 SSA responses, 4 responded for Central Africa, 33 for East Africa, 3 for the Horn of Africa, 46 for Southern Africa, 44 for West Africa, and 8 responded generally for all of SSA. Of the 311 experts who told us the nature of the organization to which they belong, 39 were from academic institutions, 171 were from commercial enterprises (55%), 48 were from government agencies, and 53 were from NGOs. On average, participants had 7.01 years of experience with e-business (LA 7.09, SSA 6.89).

Of the 315 experts who responded about their gender, 41 were female (12.7%) and 274 were male. Of 314 who told us their ages, 10 were below 25 years old, 90 were between 25 and 34, 112 were 35–44, 79 were 45–54, 19 were 55–64, and 4 were 65 or over. Of the 309 who reported their highest level of education, 1 respondent has only a primary education, 7 had secondary education, 16 had some post-secondary education, 93 had a bachelor's degree, 157 had master's degrees, and 35 had doctoral degrees.

Results

We tested and refined the measurement model using PLS Graph 3.0, involving four steps (Chin, 1998): confirmatory factor analysis, checking for cross-loadings, reliability measures of the constructs, and discriminant validity. This reliability analysis on the measurement model was conducted on all 316 responses from both LA and SSA. The details of these tests are recorded in the appendix, with an explanation of why we selected PLS as an appropriate technique for testing this model.

With a validated measurement model, we proceeded to conduct PLS analysis using PLS Graph 3.0 on the theoretical model to test all the hypotheses. Table 1 displays R^2 for each endogenous construct. The exogenous factors explained 18.3% of the variation in e-business capabilities and 21.1% of e-business value. General ICT policies explained 29.0% of e-business policies. General ICT and specific e-business policies explained 15.7% of ICT infrastructure. Government institutions explained 16.2% of commercial infrastructure. All R^2 values were statistically significant ($P \leq 0.01$, based on the *F*-test).

Table 1 displays the coefficients for all hypothesized paths in the model with their significances (obtained by bootstrapping with 200 re-samples). In PLS, the strength of the relationship is indicated by the magnitude of the path coefficient. Even when paths are statistically significant, with a low *P*-value (which a sufficiently large sample size could guarantee), Chin (1998) suggests, 'Standardized paths should be around 0.20 and ideally above 0.30 in order to be considered meaningful'. As predicted, e-business capabilities had a strong effect on e-business value (H1, path 0.386). There was no apparent effect of general ICT policies on ICT infrastructure; thus H2 was not supported. Similarly, experts perceived no significant effect of general ICT policies on either e-business capabilities or value (part of the test of H3b),

Table 1 Path coefficients for national infrastructure model

		E-biz capabilities	E-biz value	Infrastructure	E-biz policies	Commerce
Sub-Saharan Africa and Latin America (n = 316)						
E-biz capabilities	→		**0.386***			
Commerce	→		0.050			
Institutions	→		**0.128**			**0.402***
E-biz policies	→	**0.320***	0.076			
General ICT policies	→	−0.040	0.050	−0.095	**0.539***	
ICT infrastructure	→	**0.208***				
R^2		**0.1828***	**0.2110***	**0.1573***	**0.2901***	**0.1617**
Sub-Saharan Africa (n = 138)						
E-biz capabilities	→		**0.314***			
Commerce	→		−0.052			
Institutions	→		**0.244***			**0.549***
E-biz policies	→	**0.392***	0.185			
General ICT policies	→	−0.007	−0.039	−0.048	**0.629***	
ICT infrastructure	→	**0.285***				
Latin America (n = 178)						
E-biz capabilities	→		**0.403***			
Commerce	→		0.117			
Institutions	→		0.041			**0.371***
E-biz policies	→	**0.228**	0.012			
General ICT policies	→	−0.069	0.096	−0.113	**0.426***	
ICT infrastructure	→	0.132				
Brazil (n = 98)						
E-biz capabilities	→		**0.437***			
Commerce	→		0.182			
Institutions	→		−0.068			**0.507***
E-biz policies	→	0.092	−0.072			
General ICT policies	→	−0.012	0.031	−0.130	**0.459***	
ICT infrastructure	→	0.030				
Latin America other than Brazil (n = 80)						
E-biz capabilities	→		**0.362***			
Commerce	→		0.103			
Institutions	→		−0.011			*0.276*
E-biz policies	→	**0.367***	0.083			
General ICT policies	→	−0.135	0.138	−0.122	**0.379***	
ICT infrastructure	→	**0.299**				

P < = 0.10; ** *P* < = 0.05; *** *P* < = 0.01.
Path coefficients (effect size) > ± 0.20 are 'important' or meaningful.
The *P*-value reflects the reliability of the measure of the path coefficient.

whereas they perceived e-business policies to be significantly influential on capabilities (H3ai) with path coefficient of 0.320, though insignificant on value (H3aii). These results support our hypothesis that experts would consider e-business policy to be more important for e-business outcomes than general ICT policies would be (H3b). In addition, general ICT policies had a strong positive relation to e-business policies (H4), with path of 0.539.

The experts perceived that ICT infrastructure would increase the specific capabilities of e-business in LA and SSA (path = 0.208) (H5). The results indicated that experts believed strong government institutions did not necessarily have much effect on value derived from

e-business (H6). The experts perceived no significant relation between commercial infrastructure on e-business value, contrary to H7. As hypothesized, government institutions were perceived to have a strong relation to commercial infrastructure, with a path coefficient of 0.402 (H8).

Because of the wide socioeconomic disparity between SSA and LA, we analyzed the model on these two world regions separately, and obtained different results for each region. Furthermore, the Latin American data were dominated by responses from Brazil (98 of 178 – 55%); this is not surprising, considering that this country has both a third of the people and a third of the GDP of the
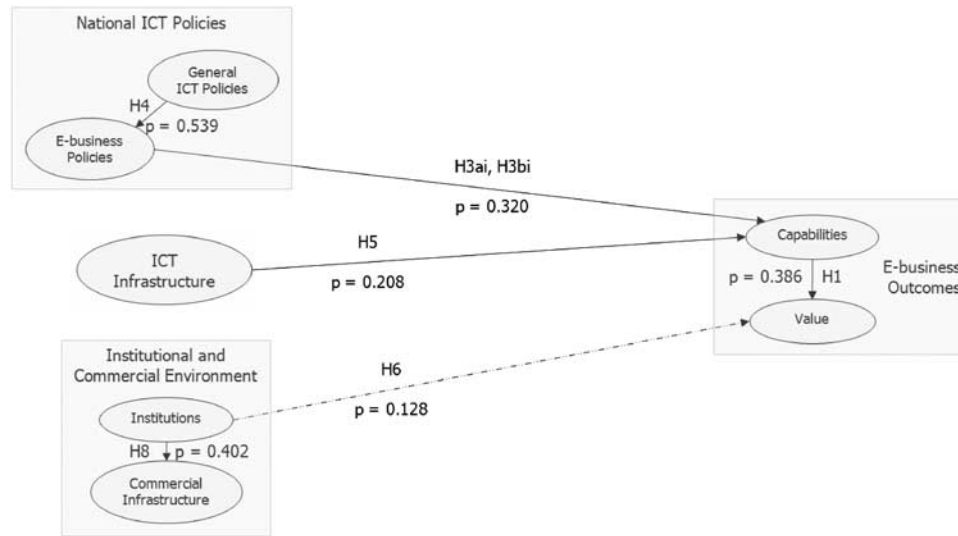
Figure 2   Results of hypothesis testing.

region (Wikipedia contributors, 2009). Thus, we analyzed Brazilian responses separately from the rest of LA and found that the results were indeed different. We report the results of these separate analyses in Table 1. We interpret the meaning of these findings and discuss their reasons and implications in the subsequent sections of this paper, focusing on specific findings in the sub-regions of the study.

We graphically illustrate the results of the combined data analysis (SSA and LA) in Figure 2. Please note that only paths significant at the 0.01 level have been added. The dotted line shows hypothesized relationships that were not significant. The solid line shows paths, hypothesized and not, that were significant.

Discussion of results

As hypothesized, we found a strong direct relationship between e-business capabilities and e-business value consistent with the theory. It makes sense that value derived from e-business follows directly from the capabilities that have been implemented. In the discussion that follows, we focus on the other factors hypothesized in this study to be directly related to e-business outcomes. To aid our interpretation of these results, we examined the numerous qualitative comments that respondents included with their quantitative responses and highlight some of these here.

General ICT policies

We were surprised to find that experts generally did not seem to feel that general ICT policies had any influence on ICT infrastructure in either SSA or LA. From reading the qualitative comments the experts gave, some apparently believed there was an influence, and were optimistic about governments' role, but, most experts felt that developing country governments are doing little by way of policy to further ICTs in their countries.

A number of cynical comments from SSA expressed little confidence in governments' ability to significantly influence ICT infrastructure through general ICT policies, suggesting that many experts believed that even when governments might establish general ICT policies, they often do not carry out these policies. Because of this disconnect between policy enactment and follow-through, the establishment or non-establishment of ICT policies has little influence on the actual incidence of ICT infrastructure. Thus, although many African countries have enacted general policies to govern ICT penetration in their countries, the following concerns from respondents remain:

Many developed ICT policies just end on paper and are never translated to action; hence moving from policy to implementation is still a major challenge. One of the reasons for such lack of policy implantation [sic] is that most African governments have done a poor job in communicating these policies to those that are supposed to implement them. For example, in Cameroon the government enacted a great policy to promote computer imports to the country with zero custom duty. However, most customs officers have little knowledge about computing such that if one brings in a hard drive or some computer accessory such as printers and scanners, some officers insist that the person should pay the import duty.

There are hardly any annual or periodic reviews of existing policies to see how they have fared over time.

The ICT policies tend to not address specific ICT issues. For example, most African countries do not have policies to govern specific ICTs such as telemedicine, tele-education and e-business. This makes interpretation of current ICT policies very challenging.

In LA, in cases where the governments set policies, they tend to withhold important information from organizations – particularly SMEs – that could let

companies take advantage of the government resources. In general, this unfairness toward SMEs impedes the effects of policies where they exist. There was the indication that policies might tend to favor large companies that use ICTs, but ignore the needs of SMEs and consumers.

In spite of government policies, the telecommunication infrastructure is still very expensive, and so in some countries telecommunication suppliers are unwilling to make the heavy investments when they are uncertain of receiving compensating returns from the market. Heeks *et al.* (2007) cautions policymakers and private investors in developing nations to carefully assess investments in ICTs before pouring unnecessarily heavy resources on related projects/initiatives.

E-business-specific policies
Experts in all regions indicated a strong positive relationship between general ICT policies and e-business policies, suggesting that governments that implement proactive ICT policies are more likely to additionally focus on policies that are specifically tailored to promoting e-business.

In sharp contrast to their attitude on general ICT policies, the experts' strong affirmation of the effects of e-business policy in LA and SSA confirms the sentiment of various studies that have called for ICT policies that focus on issues peculiar to e-business, such as those concerning digital signatures and intellectual property rights for digital products (Jarvenpaa and Tiller, 1999; Kardaras and Karakostas, 2001). However, our study found that this effect is limited to the relationship between e-business policies and e-business capabilities; there was no significant direct relationship found with value derived from e-business. This indicates that while experts believed that focused policies do increase their countries' capabilities in e-business, policy in itself cannot assure economic benefits. The only exception was in Brazil, where experts did not believe e-business policy was related to either capabilities or value. We will discuss the Brazilian situation shortly in our discussion of ICT infrastructure.

ICT infrastructure
The experts generally believed that ICT infrastructure would significantly affect e-business capabilities, but not necessarily e-business value. This finding indicated that experts distinguished between infrastructure's ability to enable specific capabilities and the likelihood that it would give value to those SSA businesses that employed it. The literature we have found on the effects of ICT does not generally distinguish between the capabilities it enables and its value; these two dimensions are generally lumped together. However, it seems that more literature tends to consider the benefits of ICT in terms of the capabilities it would enable for its users. Thus, our findings regarding e-business capabilities were consistent with the literature.

The only exception was in Brazil, where experts did not believe ICT infrastructure was related to either capabil-

ities or value. Expert comments indicated that the Brazilian government 'loses itself in so many protectionist and paternalist measures', imposing high taxes on SMEs and permitting exorbitant tariffs and access fees to ICTs, especially Internet access. Although they indicated that ICTs are fairly developed in large urban centers, most SMEs are unable to afford them, and so their presence fails to translate into e-business capabilities.

In order to improve the infrastructure, some experts indicated that competition is needed, as monopoly telecommunication providers are generally not proactive in extending the reach of the infrastructure, or in improving efficiency to lower costs and prices. In addition, wireless infrastructure (both for local area networks and metropolitan area networks) was suggested as a possible solution to some of the hindrances against the growth of cable-based infrastructure.

In contrast to their belief on its effect on e-business capabilities, the experts believed that ICT infrastructure in itself does not necessarily contribute toward e-business value. This makes sense, considering that even if SSA businesses were able to set-up advanced websites with many interactive features, they might nonetheless be unable to get much value out of them for many possible reasons. For example, poor payment systems might prohibit online business, and low levels of trust might discourage electronic transactions. Generally speaking, the infrastructure is gradually improving, so the capabilities should improve. However, costs are high so it will take years before value is realized.

Moreover, because few telecommunication markets are competitive, the existing providers do not have much of a customer service mentality that would encourage greater use, particularly among those with fewer resources, such as SMEs. It could be that these providers mainly focus on larger businesses, and neglect the SME market because they are not heavily pressured by the competitive landscape. In addition, the issue of an unfair marketplace for SMEs came up, which limits the value that they can derive from e-business even in the presence of adequate natural infrastructure, which might be reserved for larger enterprises.

Institutional environment
When we come to the institutional and commercial environment, we see a strong positive relationship between government institutions and commercial infrastructure in almost all regions. It was only in the Latin American region (excluding Brazil) where this relationship was not supported. However, in considering their effects on e-business, we see considerable differences between the results in SSA and those in LA. In SSA, experts believed that strong, effective government institutions would enable e-business to yield value, as we hypothesized. This supports our conjecture that to obtain e-business value adequate ICT infrastructure is not enough – countries also need strong institutional environments.

However, in LA, experts did not believe that strong government increased the value that could be obtained

from e-business. There were a number of comments from Latin American experts that reflected the disconnect between the official status of civil liberties and governmental accountability, and the reality of daily and political life. It seems that even when freedom of the press and civil rights are granted, that political forces and corruption suppress their effects. Moreover, many citizens are apparently unaware of their rights. Finally, it seems that disunity in goals between executive and judicial arms of government could result in a nominally democratic society that serves only the interests of the wealthy and powerful, and notably not those of SMEs. Although SSA and LA differ in this regard, we have chosen to keep the path found significant for the SSA sample in our revised model that can be used for future research based on the results of our study. Caution is recommended, however, since the path might not hold for other countries or regions because of the disconnect between the official status of civil liberties and government accountability.

Commercial environment

Regarding commercial infrastructure, the results in both SSA and LA surprisingly were contrary to our hypothesis, and even contradicted Travica's (2002) findings of the necessity of commercial infrastructure in Costa Rica (though his study focused on business-to-consumer e-commerce). The experts in our study did not feel that commercial infrastructure had any effect on the value derived from e-business.

Close examination of the experts' comments revealed region-specific issues that shed further light on these findings. In SSA, experts indicated that commercial infrastructure often had little effect on e-business value because poor management of infrastructures such as railways and petroleum distribution – often government-controlled in SSA countries – impedes the effectiveness of such infrastructures even when they are present. Moreover, not only did experts believe that effective commercial infrastructure did not necessarily increase the value of e-business in SSA, but their comments indicated that many believed that a solid commercial infrastructure might actually impede the development of e-business. A few sample responses by the experts indicate this:

> For now, [traditional commercial systems] serve as largely a hindrance. African people, especially the less educated and exposed ones do not want to abandon traditional methods of trade and exchange yet.

> The traditional commercial systems would normally look at e-business as a competitive system and try to combat it in all forms when it would have been developed. The middle-men in the traditional commercial system shall form syndicates to combat the e-business system as it threatens their profit maximisation or call it profiteering. e-Business Policies to be developed in Sub-Sahara Africa have to take account of this.

> In general the people believe in seeing the person they are conducting business with rather that the very formal avenue provided by the electronic media which they consider very rude cold and unfriendly.

Many apparently felt that comfort with traditional commercial institutions would inhibit the adoption of e-business, both by businesses providing Internet services and by consumers using them. It seems that while business people in SSA are generally content with the commercial systems – or rather are not sufficiently aware or do not sufficiently appreciate the potential of e-business – such complacency limits the potential value of e-business.

In LA, the inequity of the business atmosphere was cited as presenting serious obstacles that impede the success of SMEs – not only related to e-business, but regarding business in general. Thus, an improved commercial infrastructure will not necessarily enhance their practice of e-business. A different result might have been seen in a study of larger businesses. Another issue that came up in LA is the significant distinction between traditional and electronic business. SMEs are familiar with dealing with corruption and fraud in traditional business, but e-business introduces many new possibilities for fraud, which they are not willing to risk. They are not sufficiently educated about e-business to effectively take the necessary precautions, but they are well aware of the fraud risks reported in the news. Thus there is little confidence in electronic transactions.

Concluding comments

Implications for practice

The national infrastructure factors in the model we presented here identify environmental factors over which managers have little control. However, being aware of this model may aid these managers with their e-business capabilities and e-business value. For example, being aware that the experts believed that e-business capabilities flourish best in an environment with good ICT infrastructure and supportive policies focused on e-business may help managers who are considering implementing e-business, or trying to expand their capabilities and profit from their efforts.

In addition, government policymakers and NGO officials, who might have more control over environmental factors, being conscious of the experts' beliefs regarding policies and e-business value, may be assisted to design, enact, and implement supportive e-business policies that actually create an environment conducive to e-business. In this way, industry can receive value from the policymakers' efforts. Moreover, noting that the experts believed that implementing supportive e-business policies rather than general ICT policies can aid in growing a good ICT infrastructure may help government policymakers and NGO officials offset developing countries' poor ICT infrastructure dilemma, and consequent slow economic growth. ICT infrastructure is highly correlated with the level of economic development; thus, developing countries, with their deficiencies in economic development, are at a great disadvantage. From the results of this study, policymakers can implement specific

e-business policies that could help grow ICT infrastructure rather than enacting more general ICT policies that apparently do not have much effect on the infrastructure. In this way these policy makers can offset the economic constraints that often limit ICT infrastructure.

Implications for research and directions for future research

This study has demonstrated that it is important that research on the e-business outcomes in any region of the world be careful to distinguish between specific capabilities and value. While related, these dimensions have a different set of antecedents. Perhaps we could use very different structural models to explain the effects of each of these dimensions. For example, in this study, experts believed that better ICT infrastructure increased the capabilities of e-business. Future research could examine both constructs more closely, and analyze which specific ICTs and infrastructural elements contribute to which specific e-business capabilities. It is likely that differences would be found. However, if such a study were to lump e-business capabilities together with value, it might be more difficult to identify the effects of specific elements of ICT.

Moreover, another future research direction involves deeper investigation of the national commercial infrastructure. The operationalization of the national commercial infrastructure in this study might not encompass all pertinent components. The final, refined instrument only covered corruption, delivery and transportation of infrastructure, and e-payment systems, due to the limitations inherent in such a broad study. However, the experts' comments, which elucidated why they generally felt that traditional commerce had little effect on e-business in SSA, give numerous ideas for potentially fruitful lines of deeper investigation.

In addition, our study implies that an option for future research is conducting carefully targeted case studies in rural areas. Although we explained our reason for limiting our study to urban areas, a number of the experts highlighted the critical need for studying the potential of e-business for rural areas, particularly in SSA. Quantitative surveys like this would be impractical to study business use of the Internet in rural areas of developing countries. However, carefully targeted case studies of existing practices might provide valuable insight of what might work in this context, and the environmental situation needed for e-business to succeed in rural areas.

Conclusion

We conducted this study to help answer the question: What kinds of national infrastructure contribute toward effective e-business outcomes in developing countries? Our study clearly distinguishes between two different dimensions of e-business outcomes: specific capabilities and value derived from e-business. This distinction came out most clearly when contrasting the effects of ICT infrastructure, which experts believed affected e-business capabilities but not value, with the effects of government institutions, which they believed affected the value derived from e-business but did not significantly affect the specific capabilities that would be applied.

Our modeling and testing empirically examined the opinions of field experts about the effects of national government institutions and commercial infrastructure on e-business outcomes. Although much theoretical literature has proposed and discussed the effects of different aspects of the institutional and commercial environment on e-business (Jarvenpaa and Tiller, 1999; Bridges.org, 2001; Kardaras and Karakostas, 2001; Boateng *et al.*, 2009), our work operationalized these constructs and empirically tested for their effects on e-business.

This study provides empirical support for studies that have argued conceptually for the need of ICT policies specific to the needs of e-business (UNECA, 1999b; Licker and Motts, 2000; Darley, 2001; Montealegre, 2001; Okunoye and Karsten, 2002; Okoli and Mbarika, 2003; Hinson *et al.*, 2009). By showing that experts believe that e-business policies have strong effects on specific e-business outcomes, our study adds weight to this call for focused policies.

In this study, we focused on urban SMEs and went beyond the plethora of technology transfer problems faced by LA and SSA countries to identify factors that would affect e-business transfer to these regions. Rather than jump to the conclusion that LA and SSA need higher diffusion of e-business, we stepped backwards to look at some inherent precursors to wider diffusion of this technology within the studied countries.

In all, we do not claim that e-business will suddenly position African and Latin American businesses as competitive to businesses in the developed world, or that e-business will solve some of these countries' inherent socioeconomic problems such as blatant corruption and mismanagement. However, we believe that e-business, like many other ICTs, is a starting point to help these poor regions of the world leapfrog many of their challenges as they join the world's 'digital economy'.

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References

APEC (1999) APEC e-commerce readiness assessment guide: Vol. 2003. Report, Asia-Pacific Economic Cooperation report.

BINGI P, LEFF LG, SHIPCHANDLER ZE and RAO S (2000) Critical IT implementation issues in developed and developing countries. *Information Strategy* **16(2)**, 25–34.

BOATENG R, HINSON R and MBARIKA V (2009) Roadmap for e-commerce adoption in Ghana. In *Electronic Commerce and Customer Management in Ghana* (HINSON R, BOATENG R and MBARIKA V, Eds) Pro Write Publishing, Accra, Ghana.

BOON JA, BRITZ JJ and HARMSE C (1994) The information economy of South Africa: definition and measurement. *Journal of Information Science* **20(5)**, 314–323.

BRIDGES.ORG (2001) Comparison of e-readiness assessment models: Vol. 2004, retrieved from Bridges.org.

BROWN DH and LOCKETT N (2004) Potential of critical e-applications for engaging SMEs in e-business: a provider perspective. *European Journal of Information Systems* **13**, 21–34.

CHECCHI RM, SEVCIK GR, LOCH KD and STRAUB DW (2002) An instrumentation process for measuring ICT policies and culture. In *International Conference on Information Technology, Communications and Development*. Computer Association of Nepal, Kathmandu, Nepal.

CHIN WW (1998) Issues and opinion on structural equation modeling. *MIS Quarterly* **22(1)**, vii–xvi.

CHIN WW (2000) Tutorial – partial least squares for researchers: an overview and presentation of recent advances using the PLS approach. In *International Conference on Information Systems*. Brisbane, Australia.

CHIN WW, MARCOLIN BL and NEWSTED PR (1996) A partial least squares latent variable modeling approach for measuring interaction effects: results from a Monte Carlo simulation study and voice mail emotion/adoption study. In *Proceedings of the 17th International Conference on Information Systems* (DEGROSS J, JARVENPAA S and SRINIVASAN A, Eds), pp 21–41, Association for Information Systems, Cleveland, OH.

CHIN WW and NEWSTED PR (1999) Structural equation modeling analysis with small samples using partial least squares. In *Statistical Strategies for Small Sample Research* (HOYLE R, Ed), pp 307–341, Sage, Thousand Oaks, CA.

DANIEL EM and HUGH NW (2003) The role of dynamic capabilities in e-business transformation. *European Journal of Information Systems* **12**, 282–296.

DARLEY WK (2001) The Internet and emerging e-commerce: challenges and implications for management in Sub-Saharan Africa. *Journal of Global Information Technology Management* **4(4)**, 4–18.

DEKLEVA S (2000) Electronic commerce: a half-empty glass? *Communications of the AIS* **3(18)**, 2–99.

DICKINGER A, MITRA A and MEYER D (2008) The role of perceived enjoyment and social norm in the adoption of technology with network externalities. *European Journal of Information Systems* **17(1)**, 4–11.

DUTTA A (1997) The physical infrastructure for electronic commerce in developing nations: historical trends and the impact of privatization. *International Journal of Electronic Commerce* **2(1)**, 61–83.

DUTTA A (2001) Telecommunications and economic activity: an analysis of Granger causality. *Journal of Management Information Systems* **17(4)**, 71–95.

EASTERLY W and LEVINE R (2002) Tropics, germs, and crops: how endowments influence economic development. *Journal of Monetary Economics* **50(1)**, 3–39.

EZE E (2002) A critical examination of strategic planning and implementation of information technology in developing countries. *International Journal of Services Technology and Management* **3(4)**, 429–440.

FICHMAN RG (2000) The diffusion and assimilation of information technology innovations. In *Framing the Domains of IT Research: Glimpsing the Future Through the Past* (ZMUD RW, Ed), p 464, Pinnaflex Educational Resources, Cincinnati, OH.

GENGATHAREN D and STANDING C (2005) A framework to assess the factors affecting success or failure of the implementation of government-supported regional e-marketplaces for SMEs. *European Journal of Information Systems* **14(4)**, 417–433.

GREENWELL M (1988) *Knowledge Engineering For Expert Systems*. Ellis Harwood, Chichester.

GURBAXANI V, KRAEMER KL and KING JL *et al.* (1990) Government as the driving force toward the information society: national computer policy in Singapore. *The Information Society* **7(2)**, 155–185.

HAIR JF, ANDERSON RE, TATHAM RL and BLACK WC (1998) *Multivariate Data Analysis*. Prentice-Hall, Upper Saddle River, NJ.

HEEKS R, STANFORTH C and HEEKS R (2007) Understanding e-government project trajectories from an actor-network perspective. *European Journal of Information Systems* **16**, 165–177.

HILL C, LOCH KD, STRAUB DW and EL-SHESHAI K (1998) A qualitative assessment of Arab culture and information technology transfer. *Journal of Global Information Management* **6(3)**, 29–38.

HILL C, STRAUB DW, LOCH KD, COTTERMAN W and EL-SHESHAI K (1994) The impact of Arab culture on the diffusion of information technology: a culture-centered model. In *Proceedings of The Impact of Informatics on Society: Key Issues for Developing Countries, IFIP 9.4*. IFIP, Havana, Cuba.

HINSON R, BOATENG R and MBARIKA V (2009) *Electronic Commerce and Customer Management in Ghana*. Pro Write Publishing, Accra, Ghana.

JARVENPAA SL and LEIDNER DE (1998) An information company in Mexico: extending the resource-based view of the firm to a developing country context. *Information Systems Research* **9(4)**, 342–361.

JARVENPAA SL and TILLER EH (1999) Integrating market, technology, and policy opportunities in e-business strategy. *Journal of Strategic Information Systems* **8(3)**, 235–249.

KABA B, NDA K and MBARIKA V (2008) Understanding the factors influencing the attitude toward and the use of mobile technology in developing countries: a model of cellular phone use in Guinea. In *Proceedings of the 41st Hawaii International Conference on System Sciences*. IEEE Computer Society, Hawaii.

KAHRAMAN C, DEMIREL NA, DEMIREL T and KAHRAMAN C (2007) Prioritization of e-government strategies using a SWOT-AHP analysis: the case of Turkey. *European Journal of Information Systems* **16**, 284–298.

KARDARAS D and KARAKOSTAS B (2001) An empirical investigation of the management practices and the development of electronic commerce in Mauritius. *International Journal of Information Management* **21(6)**, 441–455.

KIFLE M, MBARIKA V and OKOLI C *et al.* (2008) A TeleMedicine transfer model for sub-Saharan Africa. In *Proceedings of the 41st Hawaii International Conference on System Sciences*. IEEE Computer Society, Hawaii.

KING JL, GURBAXANI V and KRAEMER KL *et al.* (1994) Institutional factors in information technology innovation. *Information Systems Research* **5(2)**, 139–169.

KIRKMAN G, CORNELIUS PK, SACHS JD and SCHWAB K (2002) The global information technology report 2001–2002: readiness for the networked world. Report, Oxford University Press, Oxford.

LEBLANC P, MBARIKA VAW, MCCOY S and MESO P (2004) TeleDemocracy in developing countries: a focus on Sub-Saharan Africa. In *2004 Information Resource Management Association International Conference*. New Orleans.

LICKER P and MOTTS N (2000) Extending the benefits of e-commerce in Africa: exploratory phase. In *First Annual Global Information Technology*

Management World Conference (PALVIA PC, Ed) Global Information Technology Management Association, Memphis, Tennessee.

LISHAN A (1996) Electronic communications technology and development on internet in Africa. *Information Technology for Development* **7(3)**, 133.

LOCH K, NELSON G and STRAUB DW (2000a) NSF project summary: IT transfer to Egypt: a process model for developing countries. Report, Georgia State University, Georgia.

LOCH K, STRAUB DW and KAMEL S (2000b) Use of the internet: a study of individuals and organizations in the Arab world. In *Global Information Technology Management Conference*. Global Information Technology Management Association, Memphis, TN.

MACKAY N, PARENT M and GEMINO A (2004) A model of electronic commerce adoption by small voluntary organizations. *European Journal of Information Systems* **13**, 147–159.

MADON S (2005) Governance lessons from the experience of telecentres in Kerala. *European Journal of Information Systems* **14**, 401–416.

MBARIKA V, COBB-PAYTON F, KVASNY L and AMADI A (2007a) IT education and workforce participation: a new era for women in Kenya? *The Information Society* **23(1)**, 1–18.

MBARIKA V, KAH MM, SAMAKE K and SUMRALL J (2007b) The diffusion of cyber cafés in Sub-Saharan Africa: country case studies. *IEEE Technology and Society* **23(6)**, 49–56.

MBARIKA VWA (2001) *Africa's Least Developed Countries: Teledensity Problems and Strategies*. ME & AGWECAMS Publishers, Yaoundé, Cameroon.

MBARIKA VWA, BYRD TA, RAYMOND J and MCMULLEN P (2001) Investments in telecommunications infrastructure are not the panacea for least developed countries leapfrogging growth of teledensity. *International Journal on Media Management* **2(1)**, 133–142.

MCLOUGHLIN GJ (2000) The national information infrastructure: the federal role. Report, U.S. Department of State: Resources, Science, and Industry Division.

MEKONNEN SM and SAHAY S (2008) An institutional analysis on the dynamics of the interaction between standardizing and scaling processes: a case study from Ethiopia. *European Journal of Information Systems* **17**, 279–289.

MESO P, CHECCHI RM, SEVCIK GR, LOCH KD and STRAUB DW (2003) Bounded rationality and sectoral differences in diffusion of national IT policies. In *IFIP WG 9.4*. Athens.

MESO P, MBARIKA VAW and MUSA PF (2005) Towards a model of consumer use of mobile information and communication technology in LDCs: the case of Sub-Saharan Africa. *Information Systems Journal* **15(2)**, 119–146.

MONTEALEGRE R (1999) A temporal model of institutional interventions for information technology adoption in less-developed countries. *Journal of Management Information Systems* **16(1)**, 207–232.

MONTEALEGRE R (2001) Four visions of e-commerce in Latin America in the year 2010. *Thunderbird International Business Review* **43(6)**, 717–735.

NAMBISAN S, AGARWAL R and TANNIRU M (1999) Organizational mechanisms for enhancing user innovation in information technology. *MIS Quarterly* **23(3)**, 365–395.

NGAI EWT and WAT FKT (2002) A literature review and classification of electronic commerce research. *Information & Management* **39(5)**, 415–429.

ODEDRA-STRAUB M (1993) Critical factors affecting success of CBIS: cases from Africa. *Journal of Global Information Management* **1(3)**, 16.

OKOLI C and MBARIKA VWA (2003) A framework for assessing e-commerce in Sub-Saharan Africa. *Journal of Global Information Technology Management* **6(3)**, 44.

OKUNOYE A and KARSTEN H (2002) Where the global needs the local: variation in enablers in the knowledge management process. *Journal of Global Information Technology Management* **5(3)**, 12–31.

OTIM S and GROVER V (2006) An empirical study on web-based services and customer loyalty. *European Journal of Information Systems* **15**, 527–541.

PETRAZZINI B and KIBATI M (1999) The internet in developing countries. *Communications of the ACM* **42(6)**, 31–36.

RAMAN KS and YAP CS (1996) From a resource rich country to an information rich society: an evaluation on Information Technology policies in Malaysia. *Information Technology for Development* **7(3)**, 109–131.

ROSE G and STRAUB DW (1998) Predicting general IT use: applying TAM to the Arabic world. *Journal of Global Information Management* **6(3)**, 39–46.

SACHS JD and WARNER AM (1997) Sources of slow growth in African economies. *Journal of African Economies* **6(3)**, 335–376.

SOOD S, NWABUEZE S and MBARIKA VWA *et al.* (2008) Electronic medical records: a review comparing the challenges in developed and developing countries. In *Proceedings of the 41st Hawaii International Conference on System Sciences*. IEEE Computer Society, Hawaii.

STRAUB DW (2005) ACIT-APIT: relevant publications and papers (1998 – Present). *Arab Culture and IT – Arab Policy and IT.* [WWW document] http://dstraub.cis.gsu.edu/acit-apit/output/pubs.asp.

STRAUB DW, HOFFMAN DL, WEBER BW and STEINFIELD C (2002) Toward new metrics for net-enhanced organizations. *Information Systems Research* **13(3)**, 227–238.

STRAUB DW, LOCH KD and HILL CE (2001) Transfer of information technology to developing countries: a test of cultural influence modeling in the Arab world. *Journal of Global Information Management* **9(4)**, 6–28.

TRACTINSKY N and JARVENPAA SL (1995) Information systems design decisions in a global versus domestic context. *MIS Quarterly* **19(4)**, 507–534.

TRAVICA B (2002) Diffusion of electronic commerce in developing countries: the case of Costa Rica. *Journal of Global Information Technology Management* **5(1)**, 4–24.

TURBAN E (1995) *Decision Support and Expert Systems*. Prentice Hall, Englewoods Cliffs, NJ.

UNCTAD (2002) E-commerce and development 2002. Report, United Nations Conference on Trade and Development.

UNECA (1999a) The process of developing national information and communications infrastructure (NICI) in Africa: Vol. 2005. Report, United Nations Economic Commission for Africa.

UNECA (1999b) Electronic commerce in Africa: Vol. 2004. Report, United Nations Economic Commission for Africa.

WIKIPEDIA CONTRIBUTORS (2009) Latin America. In *Wikipedia, The Free Encyclopedia* Wikimedia Foundation, [WWW document] http://en.wikipedia.org/w/index.php?title=Latin_America&oldid=326165976 (accessed 16 November).

WOLCOTT P, PRESS L, MCHENRY W, GOODMAN SE and FOSTER W (2001) A framework for assessing the global diffusion of the internet. *Journal of the Association for Information Systems* **2(6)**, 1–50.

ZHU K, DONG S, XU SX and KRAEMER KL (2006) Innovation diffusion in global contexts: determinants of post-adoption digital transformation of European companies. *European Journal of Information Systems* **15**, 601–616.

ZHU K and KRAEMER KL (2002) E-commerce metrics for net-enhanced organizations: assessing the value e-commerce to firm performance in the manufacturing sector. *Information Systems Research* **13(3)**, 275–295.

Appendix

Details of PLS analysis

Choice of statistical technique: partial least squares (PLS)

Chin and Newsted (1999) compared and contrasted SEM and PLS, outlining which situation is appropriate for which technique. There are a number of reasons why PLS was clearly the better approach for analyzing the model in this current research. First, PLS is more appropriate in

Table A1   Confirmatory factor analysis

Construct	Item	Initial instrument		Refined instrument		
		Weight	Loading	Weight	Loading	Composite reliability
E-business capabilities	EBCI	0.233	0.820	0.230	0.819	
	EBCT	0.271	0.916	0.270	0.915	
	EBCX	0.247	0.907	0.248	0.907	0.926
	EBCS	0.233	0.844	0.234	0.844	
	EBCN	0.196	0.728	0.198	0.729	
E-business value	EBVR	0.387	0.829	0.423	0.831	
	EBVC	0.322	0.877	0.355	0.894	
	EBVT	0.339	0.875	0.373	0.891	0.905
	EBVJN	0.179	0.593			
	EBVJL	0.011	−0.105			
ICT policy	IPIS	0.260	0.858	0.295	0.889	
	IPID	0.276	0.892	0.313	0.923	
	IPRS	0.214	0.835	0.246	0.870	0.929
	IPRD	0.259	0.797	0.290	0.816	
	IPP	0.268	0.546			
E-business policy	IPEP	0.334	0.726	0.395	0.764	
	IPEI	0.320	0.785	0.380	0.817	0.852
	IPEU	0.389	0.848	0.461	0.851	
	IPEA	0.271	0.670			
ICT infrastructure	IITB	0.180	0.775	0.204	0.759	
	IIE	0.140	0.674			
	IIIW	0.178	0.725	0.193	0.721	
	IIWN	0.180	0.756	0.199	0.764	
	IIP	0.131	0.774	0.148	0.773	0.911
	III	0.166	0.825	0.182	0.829	
	IIA	0.163	0.733	0.172	0.753	
	IIQ	0.190	0.773	0.204	0.792	
Institutions	ICIV	0.323	0.751	0.294	0.735	
	ICIB	0.282	0.811	0.302	0.821	0.885
	ICIR	0.288	0.832	0.283	0.833	
	ICIL	0.341	0.861	0.351	0.866	
Commerce	ICCC	0.575	0.759			
	ICCP	0.387	0.677	0.588	0.835	0.825
	ICCD	0.423	0.721	0.610	0.842	

exploratory research such as this. SEM works best for well-defined theoretical constructs that are being conclusively confirmed. When the underlying theory is relatively new and untested, PLS is more appropriate. Second, SEM requires that the data be normally distributed to calculate appropriate relationships, a requirement that is rarely met. PLS takes a non-parametric distribution-free approach that makes no such requirement on the data. As is typical for Likert-scaled responses, none of our variables was normally distributed, so PLS was clearly more appropriate for analyzing the data in this study. Third, SEM requires large sample sizes. The standard suggestion is the lesser of 200 cases or 10 times the number of estimated parameters (in my case, $10 \times 34 = 340$) (Hair

et al., 1998). In contrast, PLS merely requires 10 times the number of items in the construct with the most incoming structural paths (Chin, 2000). In our case, these constructs were e-business capabilities and e-business values with five items apiece, for a minimum requirement of 50. Our smallest analyzed sub-sample of 80 (Latin America (LA) other than Brazil) amply met the PLS requirement, but failed that of SEM. In technology research in developing countries, it is very difficult to obtain larger samples. For these three reasons, we selected PLS as the appropriate analysis approach for this study.

Testing and refining the measurement (outer) model   There are four steps involved in testing and refining the

Table A2 Correlations between latent constructs (φ matrix) Square root of AVE is in the leading diagonal

	AVE	EBC	EBV	IPIR	IPE	II	ICI	ICC
E-business capabilities	0.715	**0.846**						
E-business value	0.761	0.419	**0.872**					
Commerce	0.703	0.256	0.18	**0.838**				
Institutions	0.659	0.135	0.199	0.402	**0.812**			
E-business policy	0.659	0.36	0.275	0.336	0.418	**0.812**		
General ICT policy	0.766	0.15	0.166	0.121	0.196	0.539	**0.875**	
ICT infrastructure	0.594	0.322	0.148	0.537	0.443	0.389	0.142	**0.771**

measurement model (Chin, 1998): confirmatory factor analysis, checking for cross-loadings, reliability measures of the constructs, and discriminant validity. This reliability analysis on the measurement model was conducted on all 316 responses from both Latin America and Sub-Saharan Africa.

Confirmatory factor analysis (CFA) The first step in testing and refining the measurement model was to conduct CFA. This ensured that, in a factor analysis of all the items in the instrument, each item loaded on the construct to which it is theoretically assigned. We used PLS Graph 3.00 to run the overall model we theoretically specified in Figure 1. This run generates weights and loadings for each item on their respective constructs. (The weights were irrelevant for our model, since we have no formative constructs.) The loadings are the factor-analytic loadings for each item on its respective latent construct. Chin (1998) indicates that to be retained in the analysis, each item should have a standardized loading of at least 0.707 on its respective factor. In Table A1, we highlight the six loadings that do not meet this criterion. We dropped these six from subsequent analysis.

Checking for cross-loadings The next step in testing the measurement model was to assess if any item cross-loaded on a construct other than the one for which it is theoretically specified Chin (1998). After removing the six items that did not pass the CFA, we used PLS Graph to generate latent variable scores for all six constructs with the 28 items that were left. We standardized the raw scores of all the items (that is, subtracted the mean and divided by the standard deviation), and generated Pearson's correlation coefficients for the items against the latent variable scores. The cross-loading showed that no item loaded at more than 0.707 on any construct other than that for which we theoretically specified it.

This indicated that each of the 28 retained items loaded uniquely on their respective theoretical constructs.

Reliability measures of the constructs The appropriate measure for reliability for items loading on factors representing latent constructs is the composite reliability (r_c) score (Chin, 1998). This is in contrast to the Cronbach α, which weights each item equally, regardless of its factor loading. The minimum r_c should be 0.8. In Table A1, we give the composite reliabilities for each refined construct. All our constructs exceeded the 0.8 minimum, indicating that all the constructs were adequately and reliably measured. In addition to the r_c, another measure of reliability that is particularly pertinent when testing measures of latent constructs is the average variance extracted (AVE), calculated as the average of the squared loading of each item in a construct measure, which must be at least 0.5 for an acceptable measure of a latent construct. All AVEs for the latent constructs in our study were very good, as Table A2 displays.

Discriminant validity The test for discriminant validity examined the correlations between the latent factor scores of each construct in the model; this set of correlations is called the φ (phi) matrix. The test compared these correlations with the square root of the AVE for each construct pair, requiring that the correlation be smaller than the smaller of the two root-AVEs. Table A2 displays the resultant φ matrix of latent construct correlations with the square root of AVEs in the leading diagonal. In no case was any correlation equal to or larger than a root-AVE above it or to its right; this indicated that all constructs in the model were indeed distinct from each other according to the strict form of the test.

With a satisfactorily reliable instrument and a valid measurement model, we proceeded to test the structural model. This was the stage at which we could test the hypotheses.