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YOU CAN'T BRIBE A COMPUTER: DEALING WITH THE SOCIETAL CHALLENGE OF CORRUPTION THROUGH ICT[1]

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Despite the influence of information and communication technologies (ICTs) on enhancing transparency and fairness, there is limited theoretical understanding of how ICT affects corruption. Adopting an institutional perspective, we conceptualize the mechanisms through which e-government influences corruption in a nation. Specifically, we theorize the relationship between e-government and corruption at two levels: (1) ***base corruption*** *observed in national institutions (political, legal, and media institutions), and (2)* ***permeated corruption*** *in the national stakeholder service systems (business and citizen systems). Using panel data from 63 countries over a 4-year period, we test the direct and mediated effects of e-government on corruption in national institutions and stakeholder service systems, respectively. This exploratory study provides preliminary insights into the mechanisms through which corruption manifests in a nation and demonstrates how e-government can be helpful in alleviating it. In addition, the study offers important implications that we believe will be instrumental in stimulating future research on the subject.*

Keywords: Corruption, e-government, institutions, ICT impact, base corruption, permeated corruption, stakeholder service systems

Corruption isn't a natural disaster: it is the cold, calculated theft of opportunity from the men, women and children who are least able to protect themselves. Leaders must go beyond lip service and make good on their promises to provide the commitment and resources to improve governance, transparency and accountability.
— David Nussbaum, Chief Executive, Transparency International

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The appendices for this paper are located in the "Online Supplements" section of the *MIS Quarterly*'s website (http://www.misq.org).

Introduction

Corruption is often touted as one of the biggest societal challenges that serves to lock populations in cycles of misery (Kock and Gaskins 2014; Senior 2004). Generally, by promoting unproductive and manipulative behavior, corruption in nations leads to an environment of uncertainty and inefficiency that adversely affects the development of fair and efficient markets (Dawes 2010). In addition to causing internal market inefficiencies, corruption also inhibits the flow of foreign direct investments (FDIs), thereby accentuating conditions of poverty and stunted economic development (Gupta et al. 1998; Habib and Zurawicki 2002).

There is international concern about corruption as evident by the United Nations (UN) Convention against Corruption, which currently includes 140 countries. Despite this anti-corruption endorsement, the latest Transparency International (TI) report found that about 70 percent of the 175 nations surveyed had a score of less than 50 out of a clean score of 100, signifying serious levels of corruption in the majority of countries (TI 2014). Thus, corruption is clearly one of the major societal challenges that governments need to address.

Although ICTs have the transformational potential to address corruption by facilitating transparency in transactions, an understanding of the subject is still in a nascent stage—primarily because academics often view ICT and public policy as two different disciplines, which therefore need to be bridged (see Dutton 2005; Fotaki 2010; Vogel 2010). The use of ICTs by a government to enhance access to and delivery of all facets of government services and operations for the benefit of its stakeholders (such as citizens, businesses, and the government itself) is termed *e-government* (Bélanger and Carter 2012; Dwivedi et al. 2012; Srivastava 2011; Srivastava and Teo 2007; Teo et al. 2009). A recent initiative, open government, emphasizes the principles of transparency, participation, and collaboration in the government's engagement with citizens (Bertot et al. 2014). Through the use of ICT, e-government can help to achieve the principles of open government (Bertot et al. 2010; see Appendix A). Our exploratory research proposes an initial nomological network surrounding ICT (particularly e-government) and corruption, and theorizes the salient role of basic national institutions[2] and national stakeholder service systems[3] into the mechanisms through which e-government affects corruption.

This study makes several valuable contributions. First, although prior studies recognize the important role of e-government in reducing corruption in a nation, theoretically driven empirical research on the subject is relatively sparse (see Appendix B). Second, building on institutional theory, this study conceptualizes corruption in a nation as corruption in basic national institutions that proliferates as corruption in the national stakeholder service systems. This theory development approach offers a systematic explanation of the mechanisms perpetuating the impacts of corruption on service systems within nations. Third, this research makes a methodological contribution by using panel data analysis from 63 countries over a 4-year period, thereby explicitly addressing endogeneity issues. Although prior studies have also used econometric modeling, they tend to use mostly cross-sectional data analysis.

Background Literature

Corruption in National Institutions (Base Corruption)

While some researchers restrict the term *corruption* to situations where one of the transacting parties is a public official (LaPalombrara 1995; Neild 2002), others also include transactions among private parties (Macrae 1982; Senior 2004). We define corruption in a nation as the abuse of public power for private benefit (Rodriguez et al. 2005; Sandholtz and Koetzle 2000). Scholars have used a host of economic theories such as public choice theory (Rose-Ackerman 1978), game theory (Macrae 1982), and transaction cost economics (Husted 1994) to explain corruption in individuals. In addition to economic theories, behavioral scholars have suggested the importance of individual-level psychological variables for understanding corruption (see Nas et al. 1986; Rogow and Lasswell 1963). Although both economic and individual-level psychological theories explain the motivations for corrupt behavior among individuals, they fail to account for variations in the levels of corruption across countries. Prior research on corruption has found it to be a culturally variant phenomenon where some nations are more tolerant toward corruption than others (e.g. Husted 1999). In fact, a group of scholars have argued for positive impacts of corruption as the reason for its existence in certain countries where corruption is seen as speeding up bureaucratic processes (e.g., Boddewyn and Brewer 1994; Nas et al. 1986; Ring et al. 1990). In the current study, rather than focusing on the cultural theory lens, we adopt an institutional perspective to examine how e-government affects corruption in nations.

The institutional perspective is based on institutional theory and highlights the importance of considering institutional

[2]These are the institutions (or relatively permanent structures) that form the basis for a nation's functioning: political, legal, and media.

[3]These are the systems of day-to-day services and practices for the two prime stakeholder groups in a nation, viz., businesses and citizens.

structures and their relationships with corruption (see Barnett 1981; Dombrink 1988). However, an institutional perspective focusing on the differences in national institutions across countries does not take into account the mechanisms through which corruption proliferates within a nation. In an interesting study, Anand et al. (2004) synthesize economic/psychological theories with the institutional perspective to explain how individual processes of rationalization coupled with socialization may lead to the institutionalization of corruption over a period of time. Thus, a more comprehensive understanding of corruption in nations can be gained by integrating the institutional perspective with economic/psychological perspectives, as these are mutually dependent and shaped by each other.

The classical political science literature classifies the state into two major institutions—the *legislative* and the *judiciary*—that define the structures for the functioning of the various stakeholder service systems operated by the government executives (see Spencer et al. 2005). In addition, the *media* is often regarded as the third informal institution, serving as a conscience keeper and influencing many actions of the state executives (see Carey 1993; Champlin and Knoedler 2006). Hence, we conceptualize corruption in a nation as comprising corruption in the three national institutions (political, legal, and media). These three institutions provide the broad framework within which all of a nation's activities are performed, including the government's service delivery to citizens and businesses.

Corruption in Stakeholder Service Systems (Permeated Corruption)

Government executives, who hold power as a group of decision makers for a limited tenure, are different from the state, which is conceptualized as a durable institutional structure (March and Olsen 1984; Spencer et al. 2005). The institutional structures and their associated policy networks are instrumental in shaping the norms through which national actors and executives share authority and accountability for resource allocation through the various national service systems for citizens and businesses (see Murtha and Lenway 1994; Murtha et al. 1996). Thus, the actions of government actors emanate from the institutional structures that influence the nature of the government's interaction with the national stakeholders—businesses and citizens. This implies that corruption in the institutional structures of a nation can permeate and be reflected in the service delivery of various stakeholder systems that government executives operate for citizens and businesses. Thus, the extent of corruption in the three basic national institutions—political, legal, and media—directly influences the level of corruption that permeates the dependent national stakeholder service systems (business and citizen systems), as shown in Figure 1.

Corruption Mitigation: The Role of Information Flows Through E-Government

Scholars have explained corruption using different theoretical lenses, including economic, political, cultural, and psychological perspectives (Husted 1999). Yet, the dominant theoretical view on corruption employs the perspective of rational, self-interest-seeking individuals in the principal–agent–client model, where the principal is the honest public servant (or government) in charge of other public servants (the agents) who are responsible for service delivery to businesses and citizens (the clients) (Klitgaard 1988). Due to information asymmetry between the principal and the agents, the principal cannot effectively monitor the agents' work, which results in the agents working in their own self-interest. Thus, in such a situation of information asymmetry between the government (principal) and public officials (agents), where the public officials have access to a *monopoly* and also have *discretion* in administering it without sufficient *accountability,* corruption manifests (Mahmood 2004; Mistry 2012). To mitigate corruption, the information flows should be designed to reduce the agents' monopoly and power of discretion or to increase their level of accountability (DiRienzo et al. 2007).

The level of development of e-government serves to improve these information flows through three key mechanisms. First, e-government systems provide governments (principals) with an opportunity to reduce the information monopoly of public officials (agents) by providing the public with online access to information databases. Second, providing businesses and citizens with universal access to rules and procedures can also decrease the discretion of public officials. Third, when government systems are put online, many aspects of the workings of public officials are made visible and transparent to national stakeholders, thereby increasing public officials' accountability. In many cases, businesses and citizens are able to monitor the status of decisions on their applications and to react for corrective action if necessary. Hence, in general, by improving information flows, e-government fosters transparency in executive transactions, thereby mitigating corruption (Andersen 2009; Garcia-Murillo 2013).

Impact of E-Government Development on Corruption in a Nation

To measure the impact of ICT, researchers have used diverse measures such as productivity enhancement, inventory reduction, cost reduction, and competitive advantage (see Devaraj

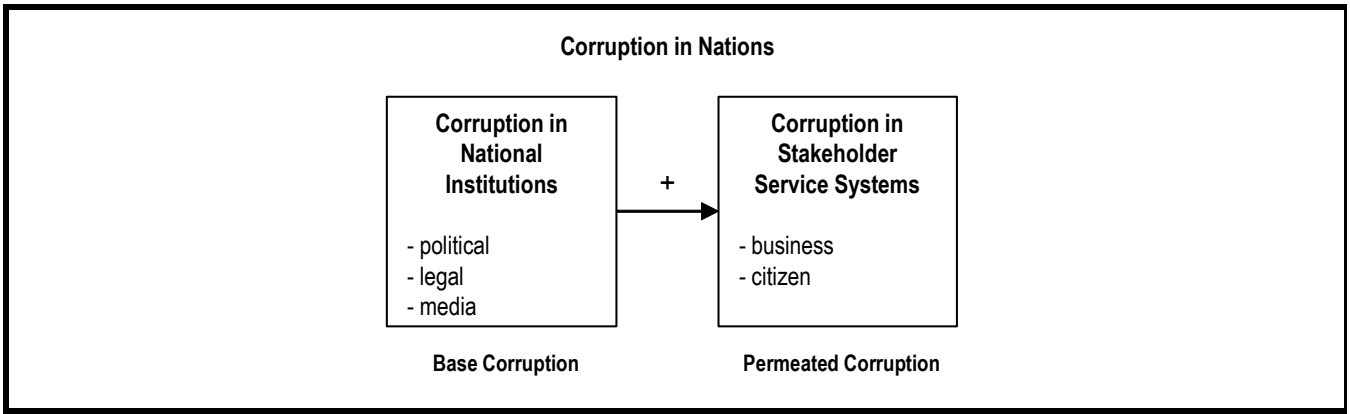

Figure 1. Conceptual Model: Corruption in Nations

and Kohli 2003; Hitt and Brynjolfsson 1996). Further, studies have used both intermediate process-level measures and organizational performance measures to assess the impact of ICT (Francalanci and Galal 1998; Melville et al. 2004; Soh and Markus 1995). While the first-order effects are generally related to process efficiency, higher-order effects are the consequential impacts of process-level efficiency on organizational performance measures (see Subramani 2004; Subramaniam and Shaw 2002). In a similar vein, national level studies have found that ICT impacts national performance by influencing intermediate efficiency- and effectiveness-related measures (see Alpar and Kim 1990; Dewan and Kraemer 2000).

Likewise, our study theorizes that corruption in a nation manifests at two levels, pervading the deep structures of the nation as corruption in national institutions (base corruption in political, legal, and media institutions) and then permeating the operational level, affecting day-to-day government transactions and services related to the primary stakeholders (permeated corruption in business and citizens systems) (Figure 2).

Hypothesis Development

Linking E-Government with Corruption in National Institutions

National Political Institutions and E-Government

National institutional structures are defined as

> collections of institutions, rules of behavior, norms, roles, physical arrangements, buildings and archives that are relatively invariant in the face of turnover of individuals and relatively resilient to the idiosyncratic preferences and expectations of individuals (March and Olsen 1984, p. 741).

National political institutions delineate the distribution of power between citizens and the government and also define how the laws for governance are formulated. The presence of a well-developed e-government has the potential to make the administrative and legislative procedures transparent (Kock and Gaskins 2014; Mistry 2012). E-government websites can provide citizens an opportunity to participate in the legislative process and to question the government about its actions (see DiRienzo et al. 2007). Similarly, e-government can help monitor the functioning of various agencies responsible for governing political institutions. For example, election commissions, constituted for the free and fair conduct of elections in many countries, have created interactive websites through which citizens not only obtain all election-related information but can also verify and update their voter information in the government's records. One example is the Election Commission of India website (http://eci.nic.in/eci/eci.html), which has all the functionalities to help citizens participate in free and fair elections. Such a simple act of providing voters with an online mode of interaction and information helps mitigate the possibility of missed or false proxy voting, which is still a major problem in many countries. Thus, by providing easy access to information and transparent government transactions with stakeholders, e-government mitigates corruption in political institutions. It follows that

> H1a. The level of e-government development in a country is negatively associated with the extent of corruption in its national political institutions.

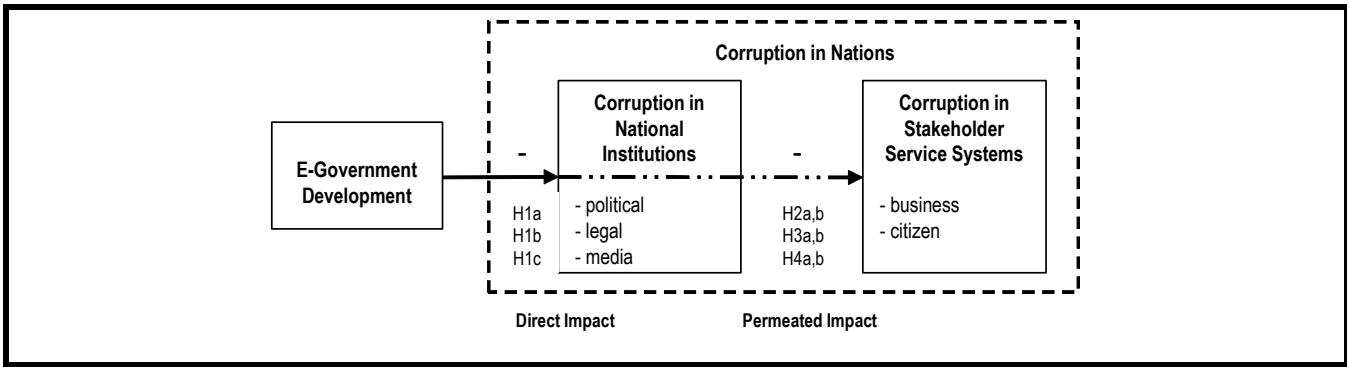

Figure 2. Research Model: E-Government and Corruption in Nations

National Legal Institutions and E-Government

The judiciary and legal systems of a country are responsible for preventing and correcting crime and unlawful use of authority within a nation. Despite the importance of legal institutions, information related to legal procedures has traditionally been relatively difficult to access, understand, and interpret. This information asymmetry results in information brokerage, which in turn leads to bribery and corrupt practices in many countries (see Kim 2014; Kim et al. 2009). By placing all information related to judicial cases and police procedures online, e-government can help mitigate this information asymmetry. E-government brings legislative as well as judicial processes under the direct scrutiny of the national stakeholders, thereby promoting rule of law (Kim 2014). In a similar vein, because e-government serves to break the government's information monopoly, citizens have direct access to a plethora of information related to the government's working (Pathak et al. 2009; Raghupathi and Wu 2011). From a judicial standpoint, e-government enables more efficient workflows and transparent court proceedings (Zinnbauer 2012). Further, it helps to inform citizens of their rights. The judiciary and police websites in many countries also serve as a channel for interaction. For example, all information about court procedures and specific judiciary cases in the state courts of Singapore can be found on the government website (https://app.statecourts.gov.sg/subcourts/index.aspx), and it is even possible to file e-litigation without an information broker (https://www.elitigation.sg/home.aspx). Similarly, the police website in Singapore can be used not only to lodge complaints but also to track them (http://www.police.gov.sg/). Thus, by providing a channel for direct interaction with the judiciary and police agencies in a nation, e-government can help mitigate corruption in legal institutions. Hence, we hypothesize:

H1b. The level of e-government development in a country is negatively associated with the extent of corruption in its national legal institutions.

National Media Institutions and E-Government

An independent and efficient media not only acts as the eyes and ears of the government, but also has the ability to highlight corrupt practices prevalent in the government, thereby creating public opinion on the subject (see Champlin and Knoedler 2006). But if the media begins advocating a highly politicized view, it can evoke controversy and support a specific political party or specific viewpoint. Consequently, it can distort public opinion and create false public opinion (Houston et al. 2011; Zhu et al. 2013). In a scenario of efficient e-government, all information about government policies and actions is directly available to citizens and businesses, so if the media attempts to distort the facts or advocate a controversial viewpoint, e-government channels can counterbalance the negative impact by directly informing and interacting with the national stakeholders. National stakeholders can thus judge the fairness of the media (whether it is reporting the issues in an unbiased perspective) and make their own decisions about the alternative views. For example, in the Unied States, direct communication from the President on the White House website (http://www.whitehouse.gov/) can counter any indirect information reported through the media. Armed with the first-hand information, national stakeholders can assess the authenticity of information provided by the media and form well-informed opinions. Thus we hypothesize:

H1c. The level of e-government development in a country is negatively associated with the extent of corruption in its national media institutions.

In summary, because e-government reduces the monopoly and discretionary power of public officials and increases their

accountability, it can help mitigate corruption (Klitgaard 1988; Mahmood 2004) in the basic national institutions.

Linking E-Government Development with Corruption in Stakeholder Service Systems

Mediation Through National Political Institutions

National political institutions define the political and legislative traditions of a nation, and the political traditions of a nation greatly influence the working of its public officials and bureaucracy. In a scenario of corrupt political institutions, public officials may become conduits for perpetuating corruption. This will impact businesses and citizens in their day-to-day interactions with government executives. For example, even to receive services to which they are entitled (such as timely issuing of business licenses and work permits), businesses and citizens may be compelled to pay bribes to public officials. Conversely, in a scenario of well-developed e-government, the workings of government become transparent and visible to all (Mistry 2012; Pathak et al. 2009). This makes businesses and citizens aware of the processes and procedures implemented by government officials and also helps identify any artificial bottlenecks that might be created by corrupt officials (see Raghupathi and Wu 2011). Consequently, if e-government initiatives alleviate corruption in national institutions, they will also be instrumental in mitigating corruption in national business and citizen service systems which are e-government functionalities that cater to the needs of businesses and citizens respectively.

Thus, there is a positive relationship between the level of corruption in national political institutions and in national stakeholder service systems. Because e-government development is expected to mitigate corruption in national political institutions (H1a), we posit that it will also mitigate corruption in business and citizen service systems, mediated through the reduction of corruption in national political institutions. Hence, we hypothesize:

H2a. The relationship between the level of e-government development in a country and the extent of corruption in its national business service systems is mediated by the corruption in its national political institutions.

H2b. The relationship between the level of e-government development in a country and the extent of corruption in its national citizen service systems is mediated by the corruption in its national political institutions.

Mediation Through National Legal Institutions

The judiciary and law enforcement systems of a country are responsible for preventing and correcting crime and unlawful use of authority within the nation. Public officials administering citizen and business services are often bound by a set of rules of conduct. The police and the judiciary of a country ensure that erring officials are apprehended and punitive action is quickly taken. The likelihood of detection and prosecution is an important factor that facilitates the prevention of corruption in stakeholder systems (Nas et al. 1986). When corruption is present, especially in a nation's legal institutions, there is a lack of transparency and fairness, and this permeates the country's business and citizen systems with corruption (see Kim 2014; Kim et al. 2009). Thus, there is a positive relationship between the levels of corruption in a country's national legal institutions and in its national stakeholder service systems. Because e-government development is expected to mitigate corruption in national legal institutions (H1b), we posit that it will also mitigate corruption in business and citizen service systems, mediated through the reduction of corruption in national legal institutions. Hence, we hypothesize:

H3a. The relationship between the level of e-government development in a country and the extent of corruption in its national business service systems is mediated by the corruption in its national legal institutions.

H3b. The relationship between the level of e-government development in a country and the extent of corruption in its national citizen service systems is mediated by the corruption in its national legal institutions.

Mediation Through National Media Institutions

In most present-day government systems, public officials as well as politicians are wary of an efficient press and media (Allern and Blach-Ørsten 2011; Kalathil 2011). If this independent watchdog institution of a nation does not fairly report events, incidents, and actions in an unbiased manner, public servants can continue to commit acts of corruption. At the other extreme, public officials may be coerced by the media to grant undue favors to certain individuals or businesses, so that factors beyond entitlement and requirement may define the rationale for delivery of government services. Thus, there is a positive relationship between the level of corruption in a country's national media institutions and in its national stakeholder service systems (see Bertot et al. 2010; Hanitzsch and Berganza 2012). Because e-government development is

expected to mitigate corruption in national media institutions (H1c), we posit that it will also mitigate corruption in business and citizen service systems, mediated through the reduction of corruption in national media institutions. Hence, we hypothesize:

H4a. The relationship between the level of e-government development in a country and the extent of corruption in its national business service systems is mediated by the corruption in its national media institutions.

H4b. The relationship between the level of e-government development in a country and the extent of corruption in its national citizen service systems is mediated by the corruption in its national media institutions.

Methodology

Data

We use three major data sources: United Nations Global E-government Readiness Reports, Transparency International Global Corruption Barometer Reports, and World Economic Forum (WEF) Global Competitiveness Reports. Data were collected for four years from 2004 through 2007. To have a consistent panel data analysis, we needed data on similar constructs across all of the years, and this was the key factor that determined the time period we examined. Further, as the variables used in this study were taken from all three sources, it was essential to consider only those countries for which data were available in all the reports. Consequently, we were left with data from the 63 countries listed in Table 1.

Constructs and Measures

The measure for e-government development is assessed through the Web Measure Index in the UN's Global E-government Readiness Reports (UN Report 2007). The five constructs for corruption specify different categories of corruption in a country and are taken from the Transparency International Global Corruption Barometer Reports (TI 2007). The different categories of corruption are indicated by a group of related corruption measures. For control variables, the measures for e-participation and human capital are taken from the UN e-government reports, while the GDP is taken from the WEF reports. The measures and their reliability and validity are given in Appendices C and D, respectively.

Data Analysis and Results

We used econometric analyses to estimate cross-sectional longitudinal models (or panel data analyses) given the variations both contemporaneous and over time. Specifically, we estimated the following system of equations:

$$\text{Corruption in Political Institutions}_{it} = \beta_0 + \beta_1 * \text{E-Government Development}_{it} + \varepsilon_{it} \quad (1)$$

$$\text{Corruption in Legal Institutions}_{it} = \beta_2 + \beta_3 * \text{E-Government Development}_{it} + \varepsilon_{it} \quad (2)$$

$$\text{Corruption in Media Institutions}_{it} = \beta_4 + \beta_5 * \text{E-Government Development}_{it} + \varepsilon_{it} \quad (3)$$

$$\text{Corruption in Business Systems}_{it} = \beta_6 + \beta_7 * \text{Corruption in Political Institutions}_{it} + \beta_8 * \text{Corruption in Legal Institutions}_{it} + \beta_9 * \text{Corruption in Media Institutions}_{it} + \beta_{10} * \text{Gross Domestic Product}_{it} + \beta_{11} * \text{Quality of Human Capital}_{it} + \beta_{12} * \text{E-Participation}_{it} + \varepsilon_{it} \quad (4)$$

$$\text{Corruption in Citizen Systems}_{it} = \beta_{13} + \beta_{14} * \text{Corruption in Political Institutions}_{it} + \beta_{15} * \text{Corruption in Legal Institutions}_{it} + \beta_{16} * \text{Corruption in Media Institutions}_{it} + \beta_{17} * \text{Gross Domestic Product}_{it} + \beta_{18} * \text{Quality of Human Capital}_{it} + \beta_{19} * \text{E-Participation}_{it} + \varepsilon_{it} \quad (5)$$

where the subscripts i and t refer to country i and year t.

The descriptive statistics and correlations of the research constructs are given in Table 2.

The research model was estimated using seemingly unrelated regression (SUR) to account for contemporaneous correlations as well as correlations over time. SUR estimates a system of equations where each has their own dependent and independent variables. The advantage of SUR is that it allows for error terms to be correlated across equations. This is more appropriate in our context because it is likely that corruption across various institutions/systems in a country are likely to be correlated, resulting in correlated errors. While ordinary least squares (OLS) regressions would provide consistent estimates, they are generally not as efficient as SUR (Greene 2002). Thus, it is preferable to use SUR over OLS because even in the restrictive situation where error terms are not correlated across equations, the SUR estimates will be as good as OLS estimates, but in more general situations, the SUR estimates are more efficient.

We tested for assumptions of normality, independence, and constant variance of the residuals. The Kolmogorov-Smirnov (KS) test did not indicate a departure from normality. White's test for heteroscedasticity supported constant variance, and

Table 1. List of Countries Analyzed

Albania, Argentina, Austria, Bolivia, Bosnia and Herzegovina, Bulgaria, Cameroon, Canada, Chile, Colombia, Costa Rica, Croatia, Czech Republic, Denmark, Dominican Republic, Ecuador, Finland, France, Georgia, Germany, Ghana, Greece, Guatemala, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Kenya, Lithuania, Luxembourg, Malaysia, Mexico, Netherlands, Nigeria, Norway, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Republic of Korea, Republic of Moldova, Romania, Russian Federation, Serbia and Montenegro, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, the former Yugoslav Republic of Macedonia, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland, United States of America, Uruguay, Venezuela
Total Number of Countries Analyzed = 63

Table 2. Descriptive Statistics and Correlation Matrix

	Variable	Mean	SD	1	2	3	4	5	6	7	8
1	EGV	0.55	0.22								
2	CPI	3.74	0.58	-0.44							
3	CLI	3.49	0.72	-0.59	0.87						
4	CMI	3.11	0.38	-0.02	0.40	0.26					
5	CBS	3.17	0.45	-0.53	0.76	0.85	0.42				
6	CCS	2.97	0.55	-0.56	0.79	0.86	0.48	0.87			
7	QHC	0.87	0.15	0.51	-0.31	-0.42	-0.06	-0.31	-0.40		
8	GDP	17008.07	15331.55	0.57	-0.61	-0.78	0.06	-0.65	-0.65	0.43	
9	EPR	0.32	0.26	0.86	-0.37	-0.49	-0.01	-0.46	-0.47	0.41	0.50

Key: EGV: e-government development; CPI: corruption in political institutions; CLI: corruption in legal institutions; CMI: corruption in media institutions; CBS: corruption in business systems; CCS: corruption in citizen systems; QHC: quality of human capital; GDP: gross domestic product; EPR: e-participation

residual plots provided support for independence assumptions. From Table 3, we observe that H1a, indicating a negative association of e-government development with corruption in political institutions, is supported ($ß = -0.48$, $p < 0.01$). H1b, which indicates a negative relationship of e-government development with corruption in legal institutions, is also supported ($ß = -0.97$, $p < 0.01$). Further, H1c, specifying a negative association between e-government development and corruption in media institutions, is also supported ($ß = -0.27$, $p < 0.05$).

To test the hypothesized mediation effects, we used both the product of coefficients (Sobel test) and bootstrap confidence intervals (Preacher and Hayes 2004, 2008). The independent variable is e-government development, which is hypothesized as decreasing the level of corruption in national service systems (business and citizen service systems), through its influence on national institutions (political, legal, and media institutions). The results for the regression equations at the two stages appear in Table 3.

Further, to test the mediation effects, we employed the Sobel test (Table 4, Upper Panel), which suggests that the level of e-government development has a negative influence on the level of corruption in business systems through corruption in legal institutions ($Z = -2.6955$, $p = 0.0035$) and corruption in media institutions ($Z = -1.9757$, $p = 0.0410$), but not through corruption in political institutions ($Z = 0.1680$, $p = 0.4333$). Similarly, the level of e-government development has a negative influence on the level of corruption in citizen systems through corruption in legal institutions ($Z = -2.8766$, $p = 0.0020$) and corruption in media institutions ($Z = -1.9145$, $p = 0.0404$), but not through corruption in political institutions ($Z = -0.1791$, $p = 0.4289$). The Sobel test assumes normality in the distribution of the indirect effect. Methodologists (e.g., Hayes 2009; Preacher and Hayes 2004; Shrout and Bolger 2002) therefore recommend that it be supplemented with bootstrap confidence intervals, which do not make assumptions about the shape of the sampling distribution. If the confidence intervals exclude zero, the indirect effect (i.e., mediation) is considered meaningful. We therefore calculated bias-corrected and accelerated confidence intervals across 5,000 bootstrap resamples; these results appear in the lower panel of Table 4. None of the confidence intervals for corruption in legal institutions included zero, which indicates support for H3a and H3b. Similarly, none of the confidence

Table 3. Regression Results: Base Corruption (National Institutions) and Permeated Corruption (Stakeholder Service Systems)

Independent Variable	Dependent Variable: Base Corruption		
	Corruption in Political Institutions	Corruption in Legal Institutions	Corruption in Media Institutions
E-government Development	-0.48 **	-0.97 **	-0.27 *
	Dependent Variable: Permeated Corruption		
	Corruption in Business Systems	Corruption in Citizen Systems	
Corruption in Political Institutions	-0.01	0.01	
Corruption in Legal Institutions	0.40 **	0.46 **	
Corruption in Media Institutions	0.31 **	0.45 **	
Control Variables			
Gross Domestic Product	-0.01 **	-0.01 **	
Quality of Human Capital	0.23 **	-0.08	
E-Participation	-0.20 **	-0.18 *	
Adjusted R-square	0.767	0.824	

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

Table 4. Mediation Analysis

Test of Indirect Effect of E-Government on Permeated Corruption				
	Product of Coefficients			
	Corruption in Business Systems		Corruption in Citizen Systems	
	Z-test	Significance	Z-test	Significance
Total	-2.7176	0.0033	-2.6197	0.0044
Corruption in Political Institutions	0.1680	0.4333	-0.1791	0.4289
Corruption in Legal Institutions	-2.6955	0.0035	-2.8766	0.0020
Corruption in Media Institutions	-1.9757	0.0410	-1.9145	0.0404
	Bootstrap Confidence Intervals			
	Corruption in Business Systems		Corruption in Citizen Systems	
	Bias-Corrected Confidence Intervals	Bias-Corrected and Accelerated Confidence Intervals	Bias-Corrected Confidence Intervals	Bias-Corrected and Accelerated Confidence Intervals
Total	-0.88 to -0.18	-0.85 to -0.16	-1.00 to -0.19	-1.00 to -0.17
Corruption in Political Institutions	-0.04 to 0.13	-0.04 to 0.12	-0.10 to 0.06	-0.10 to 0.05
Corruption in Legal Institutions	-0.82 to -0.18	-0.76 to -0.16	-0.86 to -0.20	-0.81 to -0.19
Corruption in Media Institutions	-0.24 to -0.06	-0.25 to -0.05	-0.35 to -0.09	-0.35 to -0.09

intervals for corruption in media institutions included zero, which indicates support for H4a and H4b. In contrast, all the confidence intervals for corruption in political institutions included zero, which indicates a lack of support for H2a and H2b. To address potential concerns of endogeneity, we report the results of alternative model specifications using two-stage least squares (2SLS) and three-stage least squares (3SLS) in Appendix E. Summaries of the hypothesis tests for this study are given in Appendix F, and the revised model, which can be used as a point of departure for future research, is presented in Figure 3.

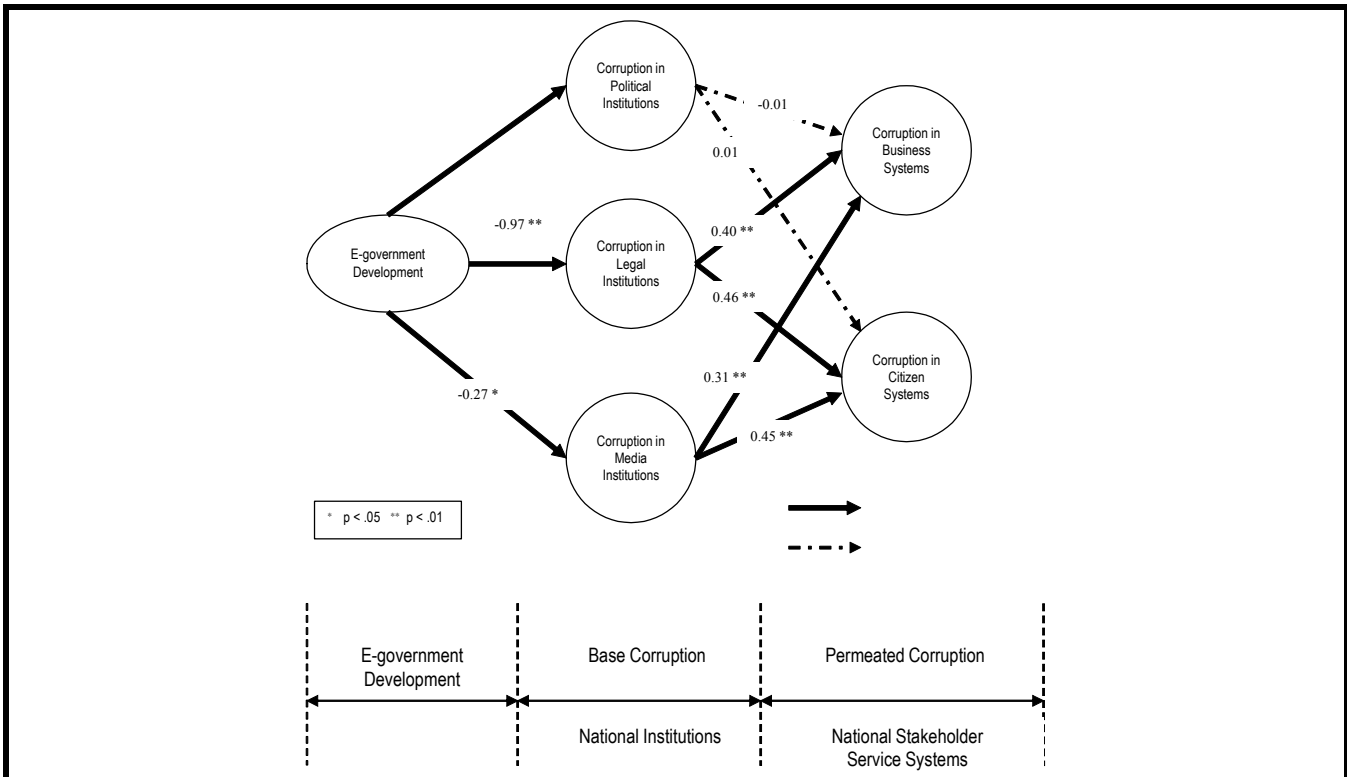

Figure 3. Revised Model: Influence of E-Government Development on Corruption in a Nation—Institutional Perspective

Discussion

The results for H1a, H1b, and H1c indicate that the level of e-government development in a nation is negatively associated with the level of corruption in the three national institutions: political, legal, and media. Further, the mediation analysis explains the underlying theoretical mechanisms permeating corruption from national institutions into the stakeholder systems (business and citizen systems) and the consequent influence of e-government thereon. The lack of support of H2a and H2b highlights the relatively less important role that corruption in political institutions has in impacting the level of corruption in stakeholder systems. A plausible reason for this counterintuitive result is that, for citizens and businesses, political institutions are generally taken-for-granted institutions with limited impact on their routine lives. Corruption in stakeholder systems seems to depend on national institutions that are closer to national stakeholders in their *vie quotidian,* thereby supporting the proximal factor argument. This is evidenced by the support for H3a, H3b, H4a, and H4b, indicating significant relationships of both corruption in legal institutions and corruption in media institutions with corruption in business and citizen systems. Both legal and media institutions are relatively proximate to a nation's citizens and businesses.

The strong support for H3a and H3b provides evidence for the important role that legal institutions play in either perpetuating or reducing corruption in national stakeholder systems. Efficient legal institutions help ensure quick disposition of judiciary processes, thereby making it difficult for corrupt executives to continuously indulge in nefarious activities (Nas et al. 1986). Corruption in both business and citizen systems is dependent to a large extent on the corruption prevalent in legal institutions. Hence, reducing levels of corruption in legal institutions may be the key to arresting corruption in business and citizen systems. Moreover, the mediation result indicates that e-government can be effective in reducing corruption in stakeholder service systems through a reduction of corruption in legal institutions.

The strong support for H4a and H4b demonstrates the important role media institutions play in influencing the level of corruption in business and citizen systems. The media is

often regarded as a vital pillar of modern government systems (Champlin and Knoedler 2006). In a regimen of free press, media reporting should be very closely related to the needs and problems of citizens and businesses. A clean and efficient media is able to impartially highlight the problems of citizens and businesses. With the growth of electronic and Internet-based media, the relevance that the media holds for citizens and businesses and its impact on them is bound to increase. Further, the mediation result indicates that e-government can be an effective means for reducing corruption in stakeholder service systems by reducing corruption in media institutions.

Overall, the results indicate that *legal* and *media* institutions are perhaps the foundational institutions for curbing corruption. When corruption is endemic in these institutions, its adverse effects tend to permeate both business and citizen service systems. Development of e-government can be one of the ways to arrest corruption in these institutions. In contrast, while political institutions are present in every nation, their corruption effects on business and citizen systems are somewhat muted, especially in the presence of strong legal and media institutions. In sum, media and legal institutions tend to be the government's watchdog and enforcer institutions, respectively, and it is therefore imperative that corruption in these institutions be mitigated as a policy measure, perhaps through e-government. Moreover, our results provide initial empirical evidence for the positive role of e-government in mitigating corruption in a nation's service delivery systems for businesses and citizens.

Implications

Implications for Research

ICT offers numerous novel affordances that can help tackle complex social challenges such as corruption (see Leonardi 2011; Majchrzak and Markus 2013; Wareham and Sonne 2008). Our exploratory study offers several implications in this direction. First, we propose and test an initial theory that conceptualizes the mechanisms through which the level of e-government development influences the level of corruption in national stakeholder service systems (citizen and business) through the level of corruption in basic national institutions (political, legal, and media). Our theory development moves beyond previous research by offering a systematic explanation of the mechanisms perpetuating corruption within nations and the role that e-government plays in alleviating it at different levels. Although preliminary, our model provides the initial foundation for a new theory of digital corruption mitigation. While we establish the need to examine corruption in basic national institutions and front-line stakeholder systems in an integrated and interdependent way, future research can expand our theory development by including other additional institutions such as religious and social institutions. In addition, we believe that this study can stimulate similar studies examining the pathways through which ICT can address other societal challenges.

Second, corruption in national systems is a frequently discussed but inadequately researched subject. Although governments and public administrators realize the ill effects of corruption, serious concerted efforts to reduce it are generally not the subject of immediate concern. One of the main reasons for the lack of academic and research attention paid to corruption is the all-pervasive and surreptitious nature of its manifestation in government working (Herzfeld and Weiss 2003). Another important reason is the lack of an organized stream of empirical research devoted to corruption that leads to questions concerning whether corruption is persistent and immutable (Seldadyo and Haan 2011). Most studies are limited to finding descriptive details regarding corruption (e.g., TI reports), rather than engaging in rigorous theory-based empirical research. In this study, building on the institutional perspective and the literature on corruption, ICT impact, and e-government, we first theorize how corruption manifests and perpetuates in a nation and then conceptualize the mechanisms through which e-government helps mitigate corruption through enhanced information flows. Given that this relationship and the associated consequences are not well understood, the presented exploratory framework and theory development will be instrumental in initiating further research on the subject.

Third, we leverage and extend the discussions in the ICT-impact literature and demonstrate how e-government development can help alleviate levels of national corruption. We contribute to the e-government literature by visualizing e-government as an opportunity for governments around the world to increase transparency in their workings, thereby making them less corrupt. Hence, this study not only contributes to the sparse literature linking ICT usage with corruption (Andersen et al. 2011) but is also one of the few cross-country studies using panel data for four consecutive years, thereby providing initial evidence about the relationship between e-government and corruption in nations at different levels. We have also suggested the mechanisms through which this happens, and future research can examine them in greater detail. Specifically, future studies can explore the processes through which e-government actually reduces the discretionary power and monopoly of public officials and enhances their accountability. Researchers can also extend the model to incorporate other variables affecting corruption.

Implications for Practice

This study also has several implications for practice, especially for policy makers. *First,* we provide empirical evidence for the negative relationship between e-government and corruption, thereby helping public administrators and policy makers better understand how e-government orchestrates corruption mitigation in a nation. Our research model provides the mechanisms through which corruption permeates from the institutional level to the functional service level in a nation, and it also explains how e-government can be instrumental in alleviating it at both levels. When designing policies related to corruption, policy makers can use the delineated model as their frame of reference to focus on different institutions and systems in relation to their contextual requirements (Figure 3). For example, government agencies can make transparent polices about approved vendors that can be placed online. They can also initiate web-based open discussion forums or even virtual open town hall meetings to promote transparency and accountability. In addition to e-government, policy makers can also explore other options that may provide similar benefits, for example, open data and open government (Brito et al. 2014; Janssen et al. 2012; see Appendix A). However, practitioners should also note that some city governments may resist open data initiatives as they do not want transparency (Lee et al. 2015).

Second, through our analyses, we show that the inhibiting effect of e-government development on corruption propagates to national stakeholder service systems (business and citizen) through legal and media institutions but not through political institutions. The results showing the relative importance of the different national institutions (political, legal, and media) for mitigating corruption in stakeholder systems can help policy makers prioritize resources for the development of select institutions in order to align with macro-level national policies. Clearly, from a user-centric perspective, tackling corruption in legal institutions and media institutions is the key task for governments in order to provide corruption-free systems. Moreover, we see that political institutions alone are insufficient and need to be supported by both media and legal institutions to combat corruption.

Third, the results of this study can help policy makers fine-tune their nation's investments in e-government to help reduce corruption. Further, policy makers can highlight the positive externality of "reduction of corruption" arising from e-government, even in situations where such reduction may not be a prime goal for the particular e-government implementation. The results from this research can also help public administrators justify investments in ICT projects, as our study provides initial empirical evidence that investments in ICT projects, specifically e-government, are indeed worthwhile.

Fourth, practitioners should also note that the extent to which base corruption in basic institutions (political, legal, media) permeates to corruption in stakeholder service systems (businesses and citizens) is also contingent on other factors such as the quality of human capital (e.g., literacy and education empower citizens to process information to detect corruption), GDP (e.g., wealthier countries may have a lower need for corruption), and the level of e-participation in a country (e.g., the ability to provide input and feedback to the government). It is also plausible that the extent of base corruption and the extent of corruption in stakeholder service systems may increase or decrease over time depending on economic, social, cultural, and environmental factors as well as how the three basic institutions evolve.

Limitations and Future Research Directions

Although our discussion has highlighted only the positive impacts of e-government, it would be unrealistic to assume that the impact can be brought about through ICT alone. Although ICT does provide an opportunity for making the working of government institutions and systems more transparent, care must be taken to ensure that ICT does not build on extant bureaucratic processes, thereby reinforcing the existing inefficiencies. Future research can specifically examine how ICT can transform rather than reinforce existing corruption-propagating structures.

There are several limitations of this study. First, we rely on secondary data, utilizing data points that were present across all the data sources and collected in a uniform way by the secondary agencies. Although the examined 63 countries constitute only about one third of all nations worldwide, the results provide an initial aggregated understanding of the subject. As the data were collected by secondary agencies, we are unable to check the data collection procedures and we acknowledge this concern. Further, we also acknowledge that the cultural/economic differences across the nations may bias the perceptual data. But again, most cross-national studies have this concern, because people in different countries have different perceptions.

Second, the level of aggregation in this study is at the level of the nation. However, future studies can examine the impact of e-government on corruption at more granular levels of analysis. Moreover, some recent studies have found mixed

effects of ICT on corruption (e.g., Charoensukmongkol and Moqbel 2014; Vasudevan 2008), which we believe is due to the specific contexts in which the studies were situated—for example, differences in culture can play a significant role (see Tan et al. 2006; Tan et al. 2007). Corruption is a cultural variant, and the perception of corruption across cultures can be different. Our cross-country study, which is macro in orientation, does not take into account the richness of specific contexts. Future research can take the situating contexts into account for a more nuanced understanding of corruption, possibly through the use of qualitative research methods (see Johns 2006; Markus et al. 2002).

Third, the relationship between e-government and corruption may be bidirectional (Lio et al. 2011). We acknowledge that causality is far more complex than depicted in our model. Although we conducted some statistical tests to support our arguments, the intertwined relationships of corruption and e-government with other exogenous factors cannot be denied. Nonetheless, our findings are exploratory and require further research and replication—for example, future research can examine countervailing possibilities, that is, the possibility of a positive relationship between e-government and corruption in certain contexts (see Appendix G).

Fourth, we have taken an institutional perspective, implying the key role of institutions in shaping the behavior of different stakeholders. It is also plausible that an individual agency with behavioral and economic motivations is instrumental in shaping the corruption-related practices in a nation. Future research can examine the role of e-government in impacting the proliferation of corruption in a nation from alternate perspectives.

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SPECIAL ISSUE: ICT AND SOCIAL CHALLENGES

YOU CAN'T BRIBE A COMPUTER: DEALING WITH THE SOCIETAL CHALLENGE OF CORRUPTION THROUGH ICT

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Appendix A

E-Government and Open Government

The term *e-government* generally refers to the use of ICT by the government to enhance access and delivery for all facets of government services and operations for the benefit of government stakeholders. Consequently, e-government can also be viewed as the use of technology to improve public service delivery and communication capabilities and to make governments more efficient and effective (Bélanger and Carter 2012; Srivastava and Teo 2007).

The concept of open government began as early as the 1950s and views the general availability of government information as a right of citizens, subject to certain restrictions (Parks 1957). This concept was incorporated into the Freedom of Information Act in 1966 in the United States. In 2009, President Barack Obama issued the Open Government Directive (Orszag 2009) grounded on the key principles of transparency, participation, and collaboration, which form the cornerstone of open government:

> Transparency promotes accountability by providing the public with information about what the Government is doing. Participation allows members of the public to contribute ideas and expertise so that their government can make policies with the benefit of information that is widely dispersed in society. Collaboration improves the effectiveness of Government by encouraging partnerships and cooperation within the Federal Government, across levels of government, and between the Government and private institutions (p. 1).

Federal agencies are instructed to implement this directive by publishing government information online, improving the quality of government information, creating and institutionalizing a culture of open government, and creating an enabling policy framework for open government. Emphasis is given to the potential of technology for open government.

From these definitions of e-government and open government, it is evident that ICT plays a key role in government services. Note that the concept of open government is much broader than the traditional emphasis on transparency. The current emphasis of open government also involves key elements of participation, collaboration, and innovation (Luna-Reyes and Chun 2012). Further, the concept of open government

is much broader and more detailed than e-government. For example, open government includes creating and institutionalizing a culture of transparency, participation, and collaboration whereas e-government mainly emphasizes the use of ICT for government services and operations. Nonetheless, the use of ICT in e-government plays a key role in achieving the objectives of open government. Specifically, e-government facilitates open government, as the use of ICT facilitates greater transparency in information flow, which leads to greater accountability, enhances participation by diverse stakeholders in the public policy process, and streamlines collaboration through network technologies across organizational boundaries.

Appendix B

Empirical Research on ICT and Corruption

Authors	Methodology	Results
Andersen (2009)	Econometric modeling of data from secondary sources.	Use of e-government led to reductions in corruption during the decade 1996–2006 in non-OECD countries.
Andersen et al. (2011)	Econometric modeling using data from U.S. states and cross-country data.	The Internet has reduced the extent of corruption across U.S. states and around the world.
Bhatnagar and Singh (2010)	Survey of eight projects to assess impact on client, agency, and society.	Corruption was significantly reduced or eliminated in five projects.
Charoensuk-mongkol and Moqbel (2014)	Econometric modeling of data from 42 countries from 2003–2007.	ICT can have both positive and negative effects on corruption.
Cho and Choi (2004)	Case study of OPEN (Online Procedures ENhancement for civil application).	Both citizens and officials have favorable opinions about the system's corruption control effect.
DiRienzo et al. (2007)	Regression analysis of secondary data for 85 countries.	The greater the access to information, the lower the corruption levels.
Elbahnasawy (2014)	Panel data analysis of 160 countries from 1995–2009.	E-government reduces corruption via telecommunication infrastructure and scope and quality of online services. E-government and Internet adoption are complementary in anti-corruption programs.
Garcia-Murillo (2013)	Econometric modeling of data from 2002–2005, 2008 for 208 countries.	Governments' Web presence has reduced perceptions of corruption around the world.
Kim (2014)	Statistical analyses of data for more than 200 countries.	E-government could be an effective tool to curb corruption. Rule of law is the most powerful predictor of anti-corruption effectiveness and a precondition for clean government.
Kim et al. (2009)	Case study of anticorruption system in Seoul Metropolitan Government.	The regulatory dimension was most effective and strong leadership is crucial to success.
Kock and Gaskins (2014)	Robust path analysis of data from 24 Latin American and 23 Sub-Saharan African countries from 2006–2010.	Relationship between Internet diffusion and corruption is primarily indirect and mediated by voice and accountability.
Krishnan et al. (2013)	Cross-sectional analysis of secondary data for 105 countries from 2004–2008.	While e-government maturity did not contribute to economic prosperity and environmental degradation, its value could be realized indirectly via its impacts on corruption.
Lio et al. (2011)	Panel analysis of secondary data for 70 countries from 1998–2005.	Internet adoption is positively related to corruption reduction. However, causality between Internet adoption and corruption is bidirectional.
Mahmood (2004)	Case studies of India and Bangladesh.	ICT has the potential to reduce corruption by altering the principal–agent–client relationship.

Authors	Methodology	Results
Mistry (2012)	Case study of e-governance initiatives in India.	Corruption can be mitigated through initiatives that enable transparency and accountability.
Pathak et al. (2009)	Survey of community perceptions of 400 respondents and case study of service delivery.	IT can reduce corruption and promote good governance.
Raghupathi and Wu (2011)	Hierarchical regression analysis of secondary data from 200 countries.	ICT has a significant impact on governance indicators.
Shim and Eom (2008)	Analysis of national-level data for 77 countries.	E-government has a consistently positive impact on reducing corruption.
Singh et al. (2010)	Survey of 918 citizens in India, Ethiopia, and Fiji.	E-governance is positively related to the government–citizen relationship and reduction of corruption.
Vasudevan (2008)	Survey of government officials and users of STAR and Reginet systems.	Mixed results for ICT impact on corruption.

Appendix C

Description of Research Constructs

E-Government Development

The construct *E-government Development* is indicated by the Web Measure Index from the UN E-government Readiness Reports. The Web Measure Index is an indicator of the sophistication and development of the e-government websites of a country and is based on the UN's five-stage e-government evolution model,[1] ascending in nature with each stage building upon the previous level of sophistication of a country's online presence. For countries that have established an online presence, the model defines stages of e-readiness according to a scale of progressively sophisticated business and citizen services (UN Report 2004). Countries are coded in consonance with what they provide online and their present stage of e-government evolution. The five stages of e-government in the UN model on which the country websites were coded are (1) *emerging presence*, (2) *enhanced presence*, (3) *interactive presence*, (4) *transactional presence*, and (5) *networked presence*.

Corruption in Political Institutions

The construct *Corruption in Political Institutions* is modeled as an index consisting of two indicators related to the level of corruption in (1) the political parties and (2) the parliament/legislature in each of the nations. The values are taken from the Transparency International Global Corruption Barometer. The values of the indicators for the level of corruption in political institutions are based on a national-level survey of citizens in each of the countries and range from 1 to 5, where 1 indicates "not at all corrupt" and 5 indicates "extremely corrupt."

Corruption in Legal Institutions

The construct *Corruption in Legal Institutions* is modeled as an index consisting of two indicators related to the level of corruption in (1) the police and (2) the legal system/judiciary in each of the nations. The values are taken from the Transparency International Global Corruption Barometer. The values of the indicators for the level of corruption in legal institutions are based on a national-level survey of citizens in each of the countries and range from 1 to 5, where 1 indicates "not at all corrupt" and 5 indicates "extremely corrupt."

[1]The full description of the model is available at http://www.unpan.org/egovernment3.asp.

Corruption in Media Institutions

The construct *Corruption in Media Institutions* is modeled as a single indicator index related to the level of corruption in the media in each of the nations. The values are taken from the Transparency International Global Corruption Barometer. The value of the indicator for the level of corruption in media institutions is based on a national-level survey of citizens in each of the countries and ranges from 1 to 5, where 1 indicates "not at all corrupt" and 5 indicates "extremely corrupt."

Corruption in Business Service Systems

Following a procedure similar to that for corruption in national institutions, *Corruption in Business Service Systems* is modeled as an index consisting of two indicators related to the level of corruption in (1) the business/private sector systems and (2) the registry and permit services in each of the nations. The values are taken from the Transparency International Global Corruption Barometer. The values of the indicators for the level of corruption in business systems are based on a national-level survey of citizens in each of the countries and range from 1 to 5, where 1 indicates "not at all corrupt" and 5 indicates "extremely corrupt."

Corruption in Citizen Service Systems

The construct *Corruption in Citizen Service Systems* is modeled as an index consisting of three indicators related to the level of corruption in (1) medical services, (2) the education system, and (3) utilities in each of the nations. The values are taken from the Transparency International Global Corruption Barometer. The values of the indicators for the level of corruption in citizen systems are based on a national-level survey of citizens in each of the countries and range from 1 to 5, where 1 indicates "not at all corrupt" and 5 indicates "extremely corrupt."

Quality of Human Capital

The control variable human capital is indicated by the human capital index from the UN E-government Readiness Reports. It is a composite of the adult literacy rate and the combined primary, secondary, and tertiary gross enrollment ratio, with two-thirds weight given to the literacy rate and one-third to the gross enrollment ratio. The data for the adult literacy rate and the gross enrollment ratio were drawn primarily from the United Nations Educational, Scientific and Cultural Organization (UNESCO). These were supplemented with data from the United Nations Development Program (UNDP) Human Development Report.

E-Participation

The control variable e-participation is indicated by the e-participation index from the UN E-government Readiness Reports. It assesses the quality, usefulness, and relevancy of the information and services as well as the willingness of countries to engage citizens in public policy making through the use of various e-government initiatives. E-participation aims to measure the quality of initiatives taken to improve citizens' access to information and public services and participation in public decision making. E-participation comprises three aspects: increasing the e-information available to citizens for decision making, enhancing e-consultation for deliberative and participatory processes, and supporting e-decision making to increase citizen input to decision making. The e-participation index is based on qualitative assessments of the websites, as gauged by the quality and relevancy of participatory and democratic features and services available on the e-government sites (UN Report 2004).

Gross Domestic Product (GDP)

The control variable GDP defines the standard of living in a country and is related to its productivity. It is an indicator of the nation's microeconomic capabilities. For this research we use GDP per capita adjusted for Purchasing Power Parity (PPP), the values for which are taken from World Economic Forum Global Competitiveness Reports (WEF 2004, 2005, 2006, 2007).

Appendix D

Note on Reliability and Validity of Data Used

The Transparency International (TI) Global Corruption Barometer and Global Competitiveness Reports and the UN E-Government Readiness Reports are prepared by three leading agencies (Transparency International, the World Economic Forum, and the United Nations) that have long experience and expertise in collecting, collating, and interpreting global data. The data used in this study were mostly survey data. The data used for forming the constructs for corruption in national institutions (political, legal, and media) and also the constructs for corruption in the national stakeholder systems (business and citizen) are based on survey data about the perceptions of citizens. The construct of e-government development is based on survey and coding procedures performed by trained researchers. To ensure the reliability and validity of all the constructs, we provide an overview of the methods undertaken by two of the agencies (TI and UN).

The TI Global Corruption Barometer (TI 2004, 2005, 2006, 2007) is a worldwide public opinion survey conducted for TI by Gallup International, with over 50,000 respondents (e.g., in 2005 there were 54,260 respondents). Both TI and Gallup are reputable and experienced agencies that follow stringent procedures for ensuring the reliability and validity of the collected data. As an example, the TI Global Corruption Barometer 2005 was conducted in 69 countries by Gallup International members or their partners, which means that on average, about 786 citizens from each of the countries were surveyed. To ensure a uniform representation of the population, the sampling method in most countries was based on quota sampling, using sex, age, socioeconomic condition, regional, and urban balances as variables. In some countries, random sampling was done. Sample imbalances in the data for a country were weighted (e.g., slight corrections were made to the proportions of age groups, sex, etc.) in order to provide a representative sample of the national population. The data coding and quality check, as well as the preliminary analysis, were done by Gallup International. The data were checked for internal consistency among respondents within a particular country. The standard margin of error for the survey was within the allowable statistical range, as reported by TI. The Department of Policy and Research at the International Secretariat of TI was closely associated with the data collation and analysis procedures to ensure the reliability and validity of the values reported in the TI Global Barometer Reports.

The UN followed similar procedures for ensuring validity and reliability for their survey (UN Reports 2004, 2005, 2007). The most important issue in the case of the UN surveys was the training of the researchers who actually carried out the Web survey. Multiple researchers were used to rate websites according to the stages of e-government Web development. Detailed guidelines were provided for choosing the websites and features for classification and analysis. For example, in UN Report (2004), more than 50,000 online features and services from 178 countries across six sectors were assessed, ensuring a wide coverage with reliable and consistent methods. Since the agencies followed rigorous procedures for ensuring the reliability and validity of the data, as described above, we used the data directly for our analyses.

Appendix E

Additional Analysis to Address Endogeneity

In the context of our theorized model, many exogenous variables can be related to corruption at both levels, i.e., in national institutions and in stakeholder service systems. This necessitates the modeling of endogeneity through instrumental variables. In this method, an instrument (another variable) is chosen to substitute for the explanatory variable (level of corruption), which may be correlated with the residual. An appropriate instrument is one that is correlated with the substituted explanatory variable but uncorrelated with the residual. We chose as the instrument for a country the average level of corruption over the 4-year period. This satisfies the desirable characteristics of an instrument and is consistent with literature in the information systems area modeling instrumental variables (Chari et al. 2008). We estimated the 2SLS and 3SLS models. The results are shown in Tables E1 and E2 and provide support for the results from our earlier analysis.

Figure E1. Nonlinear 2SLS Parameter Estimates

Parameter	Estimate	Std. Error	t Value	Approximate PR > |t|
CPI_EGV	-1.17	0.17	-7.05	< .0001
CLI_EGV	-2.06	0.18	-11.18	< .0001
CMI_EGV	0.00	0.12	0.03	0.9741
CBS_CPI	0.01	0.06	0.22	0.8244
CBS_CLI	0.49	0.04	10.92	< .0001
CBS_CMI	0.23	0.05	4.81	< .0001
CCS_CPI	0.00	0.07	0.02	0.9841
CCS_CLI	0.60	0.05	12.38	< .0001
CCS_CMI	0.37	0.05	.17	< .0001

Key: CPI: corruption in political institutions; EGV: e-govenrment development; CLI: corruption in legal institutions; CMI: corruption in media institutions; CBS: corruption in business systems; CCS: corruption in citizen systems.

Figure E2. Nonlinear 3SLS Parameter Estimates

Parameter	Estimate	Std. Error	t Value	Approximate PR > |t|
CPI_EGV	-1.22	0.16	-7.40	< .0001
CLI_EGV	-2.10	0.18	-11.51	< .0001
CMI_EGV	-0.12	0.11	-1.10	0.2700
CBS_CPI	-0.01	0.06	-0.14	0.8900
CBS_CLI	0.54	0.04	12.64	< .0001
CBS_CMI	0.18	0.04	4.05	< .0001
CCS_CPI	-0.02	0.06	-0.34	0.7300
CCS_CLI	0.66	0.05	13.90	< .0001
CCS_CMI	0.33	0.05	6.59	< .0001

Key: CPI: corruption in political institutions; EGV: e-govenrment development; CLI: corruption in legal institutions; CMI: corruption in media institutions; CBS: corruption in business systems; CCS: corruption in citizen systems.

Appendix F

Summary of Hypothesis Tests

No.	Hypothesis	Result
1A	E-government Development → Corruption in Political Institutions (-)	Supported
1B	E-government Development → Corruption in Legal Institutions (-)	Supported
1C	E-government Development → Corruption in Media Institutions (-)	Supported
2A	E-government Development → Corruption in Business Systems (-) Mediated by Corruption in Political Institutions	Not Supported
2B	E-government Development → Corruption in Citizen Systems (-) Mediated by Corruption in Political Institutions	Not Supported
3A	E-government Development → Corruption in Business Systems (-) Mediated by Corruption in Legal Institutions	Supported
3B	E-government Development → Corruption in Citizen Systems (-) Mediated by Corruption in Legal Institutions	Supported
4A	E-government Development → Corruption in Business Systems (-) Mediated by Corruption in Media Institutions	Supported
4B	E-government Development → Corruption in Citizen Systems (-) Mediated by Corruption in Media Institutions	Supported

Appendix G

Countervailing Possibilities Between E-Government and Corruption

Past research has also found some evidence that investments in ICT and e-government could also provide opportunities for corruption to occur. For example, although ICT investment provides technology infrastructures to monitor and control corruption, overinvestment in ICT can provide an opportunity for corruption to occur as government officials can distort the required budget and the spending to benefit themselves more than citizens. Further, there is some evidence that the relationship between ICT investment and corruption may be U-shaped (Charoensukmongkol and Moqbel 2014).

Other research has found that corruption is acceptable in some countries. For example, although e-government may streamline the processing of applications for government services, in some countries citizens often pay extra to get their processing expedited. This is because even with efficient e-government systems, conventional processing may be deliberately delayed so that citizens have little choice but to pay "speed money" to have their applications processed within a reasonable time frame. From another perspective, speed money can be viewed as good corruption as it allows citizens to get around bad laws and bureaucratic institutions. Some scholars have highlighted the positive impacts of corruption for individual firms (Boddewyn and Brewer 1994; Ring et al. 1990) and even the nation as a whole (Nas et al. 1986).

E-government may be ineffective in reducing legal corruption (e.g., legal political contributions in exchange for the passing of certain legislation, lobbying, and awards on tender based on certain subjective factors). Also, e-government may not necessarily mitigate corruption if the e-government systems are not designed to be fully automated (e.g., if the system requires cash payment rather than electronic payment) (Vasudevan 2008).

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