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."

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[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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