

Digital Economy and Corruption Perceptions: A Cross-Country Analysis

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Abstract. The motivation of this study is the lack of empirical evidence on the ability of Information Technology related factors to reduce corruption. This paper proposes a conceptual model that depicts the relationships between macro-level technology related factors and corruption perceptions. Data are collected from reputable organizations such as EIU and Transparency International. The sample used is sixty-nine countries, making the results more generalizable than those of single case studies or smaller sample size. The hypotheses are confirmed using PLS analytical procedures and the findings are reported. We discuss the results and their implications for researchers and practitioners.

Keywords: Cross-country Analysis, Corruption, Perceptions, Information and Communication Technologies, Maturity of IT Diffusion, E-commerce, Government Policy

1. INTRODUCTION

The diffusion of Information and Communication Technology (ICT) in the public sector has been remarkable in the last few decades. Public organizations use ICT to store, process, transmit, and report essential information to its stakeholders (Turban et al., 2015). It has been found that use of ICT in governments yields many benefits; improves service delivery (Ngafeeson and Merhi, 2013); increases efficiency and effectiveness (Merhi and Koong, 2016); facilitates interactivity

(Leidner, 2010); enables decentralization and transparency (Merhi and Koong, 2013); and reduces corruption (Shim and Eom, 2009). Agencies and organizations use ICT to lower their operating costs and provide faster service to clients (Goings et al., 2003). Governments also use ICT for similar reasons, namely to improve efficiency and effectiveness of its services by reducing bureaucratic impediments through directly delivery of services to citizens (Barbosa et al., 2013; Cordella and Tempini, 2015). However, the current literature lacks solid empirical studies that shed light on the nature of relationship between the use of ICT and corruption perceptions.

Corruption is an intentional act that includes but is not limited to bribery, embezzlement, and kickbacks. There are various forms of corruption such as systemic, sporadic (individual), political (grand), grand, and petty corruption all of which are either illegal or moral offenses against an individual or society (Byrne, 2007). Corruption is a problem that affects every country. It lowers the quality of life for individuals, and mostly affects the poor and middle class. By identifying the factors that reduces corruption, the world can prevent further unethical behavior in the future and increase the quality of life for everyone.

Previous studies have shown that e-government can positively influence control of corruption, economic growth, and efficiency (Hasan 2017; Lee, 2017; Lupu and Lazăr; 2015). However, these potential benefits can only be achieved if these systems are implemented properly. For successful implementation, a country must have a good IT infrastructure, good policies to ICTs, high level of digital maturity, and a good legal system. To our best knowledge, no research has investigated the impact of these specific factors on corruption perception in a country.

This study proposes a model that identifies the “technology-related” antecedents of corruption perceptions at country level. We also confirm if indeed there is a significant relationship between the technology related factors and corruption perceptions. The technology related factors are “capability of IT legal system,” “government policy and vision related to IT,” “maturity of ICT diffusion” and “digital maturity.” This paper makes the following specific contributions:

- By studying these factors, this paper expands the existing literature by identifying a list of important dimensions that influence country level corruption perceptions.
- Empirically assess the hypothesized relationships using data from sixty-nine countries ranging across all continents and developing/emerging spectrum.

To the best of our knowledge, this is the first paper that proposes a model that identifies important technology related antecedents of corruption perceptions and empirically confirms these relationships. We believe that the findings of this study will illuminate our understanding of the contributions of technology related factors at the national-level by providing a macro perspective of their influence on corruption perceptions in a country. Specifically, this study postulates that maturity of IT diffusion and digital maturity are positively related with corruption. Maturity of IT diffusion also indirectly influences corruption through digital maturity. We also argue that government policy and vision related to IT in a country is an antecedent to maturity of IT diffusion. Finally, we postulate that capability of IT legal system in a country positively influences its digital maturity.

The remainder of this paper is organized as follows. The first section presents the research model and a set of research hypotheses. We then discuss the methodology and quantitative data analysis that are used to test the hypotheses. Then conclusions and implications are presented. Finally, we discuss the limitations and future research opportunities.

2. RESEARCH MODEL AND HYPOTHESES

In this section, we provide details of each of the macro IT related factors included in the model. We also explain the relationships between these factors and corruption perceptions.

2.1 Corruption

Corruption is generally defined as the “abuse of public power or authority for private benefit” (Anokhin and Schulze, 2009) and includes bribery, clientelism, embezzlement, lobbying, and patronage. Unfortunately, corruption is found to be both pervasive and significant in all countries around the world (Shleifer and Vishny, 1993) but with significant differences. A key issue with corruption is the effect it has on governments and countries; not only does it undermine the

legitimacy of a government, it also makes reforming a corrupt government or judicial agency very difficult (Rose-Ackerman and Palifka 2016). Corruption also leads to a lack of trust between a government and its citizens; furthermore, political instability can make efforts to combat or even eradicate corruption nearly futile (Damania et al., 2004). Transparency International publishes a Corruption Perception Index, which is “arguably the most widely used indicator of corruption worldwide”¹. Based on this index, it can be seen that significant differences exist among the countries. Denmark, Finland, Sweden, New Zealand and the Netherlands are considered to be the least corrupt countries whereas South Sudan, Sudan, Afghanistan, North Korea and Somalia are considered to have the highest level of corruption in the world.

2.2 Digital Maturity

The adoption and the use of digital transactions varies across countries because of differences in the institutional and non-institutional drivers in a country. Because multiple agencies are involved in completing electronic transactions, and the financial transactions typically occur through banking channels, electronic markets are considered to be more transparent than traditional markets (Ghose and Yao, 2011). In addition, the digital transactions lend themselves to easy capture, transmission, and storage; therefore, non-reporting of such transactions is easier to detect compared to cash transactions. In other words, if most business activity is conducted using electronic transactions, then all relevant information concerning such transactions can be traced by all concerned stakeholders. Lio et al. (2011) in examining the influence of Internet adoption on corruption in seventy countries found statistically significant effects. Because electronic transactions are difficult to hide, and are transparent, we postulate that there is a positive relationship between ratio of volume of electronic transactions to the total volume of transactions of business activity and likelihood of corrupt practices. Therefore, we posit our first hypothesis:

Hypothesis 1: Digital maturity is an antecedent of corruption perceptions and is negatively related to it.

¹ ourworldindata.org

2.3 Maturity of ICT Diffusion

The implementation of an efficient and reliable ICTs infrastructure is a necessary condition for e-commerce to be conducted (Okoli et al., 2010; Zwick and Dholakia, 2008). The ability of people to use electronic channels to conduct their business depends on quality and effectiveness of Internet and mobile phone communications (Zwick and Dholakia, 2008) and computers (Elen et al., 2010). Higher broadband penetration, low Internet prices, and good quality may lead to an increase in the level of e-commerce adoption in any country. Internet security is another element of maturity of IT diffusion. Very often, digital transactions require users to enter sensitive information such as credit card numbers and their personal information in web based applications. Perception of lack of adequate security is a major reason why many consumers do not use electronic transactions. Poel and Marneffe (2016) while examining the potential cost saving in Belgium in using electronic invoicing found that individuals have significant concerns regarding the safety of e-invoicing. Gupta et al. (2015) found that perceived risk in online tax filing is negatively associated with taxpayers' behavioral intention to adopt online tax filing. Based on the foregoing discussion one can argue that, a widespread availability of internet access, reliable network connections, affordable prices, and implementation of adequate security protocols in the network and web technologies are likely to assure users to conduct transactions using the web, thus facilitating digital maturity. Ho et al. (2007) found that Internet penetration, telecommunication investment intensity, educational level, and regional contagion affected e-commerce adoption in 17 European countries. Therefore:

***Hypothesis 2.b:** The extent of ICT diffusion is an antecedent of and is positively related to digital maturity.*

The extent of diffusion of internet-based technologies is a key driver of ability of individuals and organizations to adopt and use all instruments of a digital economy. Palumbo (2015) argues that efficient infrastructure that facilitates accessibility and mobility is significant to develop a high-quality tourist offer. Gupta et al. (2015) found that convenience of service is positively associated with taxpayer satisfaction with e-filing. Therefore, we argue the quality of internet access, the bandwidth, the cost of access, availability of choices in service providers, and assurance of internet security – all are key motivating factors for

organizations and users to use ICT for conducting financial (e.g., purchase and sales), regulatory and compliance transactions (e.g., reporting of environmental conditions, filing taxes). The key to achieving these benefits is the implementation and the presence of reliable ICTs and Internet infrastructure. The relationship between corruption perceptions and level of digital economy has been described earlier in the paper. Therefore, by inductive reasoning, we can posit that:

***Hypothesis 2.a:** Extent of digital maturity is an antecedent of corruption perception. Greater the digital maturity, lower the corruption perception.*

This relationship may be mediated by other factors, which can be investigated in future research.

2.4 Capability of IT legal system

This factor determines the potency of legal institutions in rendering fair and swift justice to the concerned parties whenever disputes arise. The legal institutions should provide predictable, credible, coherent and adaptable rules for economic transactions (Zhu and Thatcher, 2010). Secure, stable and predictable legal environment can reduce uncertainties and build trust and confidence in the marketplace (Gibbs and Kraemer, 2004). Wong (2003) found that financial and legal institutions, physical infrastructure, human resources, and e-commerce policy initiatives impacted the adoption electronic transactions in Singapore. Merhi and Ahluwalia (2015; 2017) argue that legal environment influenced e-commerce adoption at the country level.

In countries where the legal system is well developed and enforcement mechanisms are efficient, consumers as well as businesses will be motivated to engage in digital transactions because they are likely to have the confidence that their interests would be protected, should any conflict arise. As a result, in countries having effective legal systems related to the conduct of digital transactions, consumers and businesses are more willing to enter into technology-based exchanges with each other. We need to make a distinction between laws related to corrupt practices and those concerning use of digital transactions; we are more focused on the latter. Thus, we posit that the effectiveness of laws related to digital transactions indirectly affect corruption perceptions. Therefore:

***Hypothesis 3:** Capability of IT legal system is an antecedent of and is positively related to e-commerce adoption in a country.*

2.5 Government Policy and Vision Related to IT

A robust and reliable telecommunication infrastructure is necessary for large scale diffusion of digital technologies and services (Mbarika et al., 2005). Research shows that the lack of telecommunication infrastructure acts as a barrier in the use of digital services (Kaba et al., 2009). In an increasingly interconnected world, countries are constantly competing with each other and trying to increase trade and commerce. In the last decade, digital technologies have spurred growth in several countries. Therefore, instruments of states are likely to benefit from applications of new technologies in order to increase or improve their economic status. While the extent and nature of involvement of state in economic activity is a separate topic, all schools of economic policies require the states to develop and articulate their vision in respect of development and implementation of information technology and associated technologies in their respective countries. The infrastructure development should be among the strategies of any country especially if high level of development is desired, whether at the technological or the economical domain. Governments are also concerned about digital divide which is a major barrier many countries are facing, both developing and developed. Therefore, we argue that a clear and long-term vision of any government on Information Technology infrastructure clearly affects the development and implementation of the IT infrastructure. This reasoning leads us to postulate:

Hypothesis 4: *IT Government policy is an antecedent and is positively related to the maturity of IT diffusion*

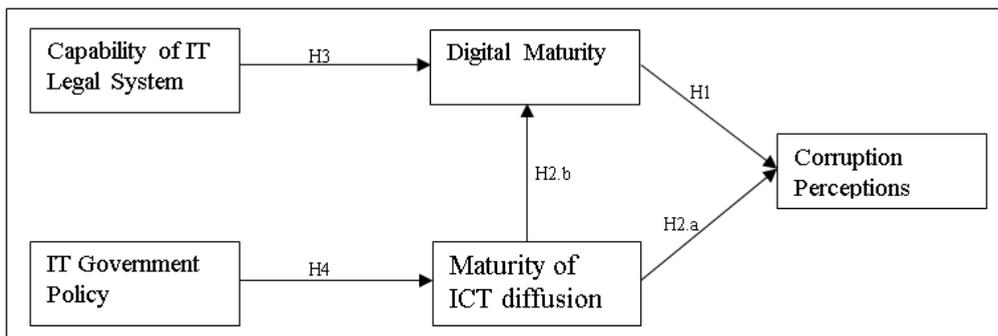


Figure 1. Proposed Research Model

3. RESEARCH DESIGN

Country level data consisting of sixty-nine countries formed the sample for conducting the empirical analysis. Because the determinants comprise of macro-level indicators, we draw the data from various indexes published by credible organizations, which possess the wherewithal to systematically track various macro level metrics at the global scale. The data used for analysis were obtained from the resources available in the websites of EIU and Transparency International. The countries used in this study are chosen based on the availability of the data. We only found data for sixty nine countries for all the factors used in this study. The data were published in 2016. The countries included in this study are: Algeria; Argentina; Australia; Austria; Azarbaijan; Belgium; Brazil; Bulgaria; Canada; Chile; China; Colombia; Czech Republic; Denmark; Ecuador; Egypt; Estonia; Finland; France; Germany; Greece; Hong kong; Hungary; India; Indonesia; Iran; Ireland; Israel; Italy; Jamaica; Japan; Jordan; Kazakhstan; Latvia; Lithuania; Malaysia; Malta; Mexico; Netherlands; New Zealand; Nigeria; Norway; Pakistan; Peru; Philippines; Poland; Portugal; Romania; Russia; Saudia Arabia; Singapore; Slovakia; Slovenia; South Africa; South Korea; Spain; Sri Lanka; Sweden; Switzerland; Taiwan; Thailand; Trinidad & Tobago; Turkey; Ukraine; United Arab Emirates; United kingdom; United States; Venezuela; and Vietnam. We now describe each of the factor and its indicators.

Digital Maturity

The digital maturity data were obtained from EIU website. The index comprised of the following indicators:

- Consumer spending on ICT per head (15%)
- Level of e-business development (10%)
- Use of Internet by consumers (25%, assessing both the range of Internet features used by individuals and their online purchasing activity)
- Use of online public services by citizens (25%) and businesses (25%)

IT Government policies

The data for this factor were obtained from EIU website. The index comprises of the following indicators:

- Government spend on ICT as a proportion of GDP (5%)

- Digital development strategy (25%)
- E-government strategy (20%)
- Online procurement (5%)
- Availability of online public services for citizens (15%) and businesses (15%)
- E-participation (15%, based on the UN e-participation index)

Capability of IT legal system

The data for this factor were obtained from EIU website. The index comprises of the following indicators:

- Effectiveness of traditional legal framework (30%)
- Laws covering the Internet (25%)
- Level of censorship (10%)
- Ease of registering a new business (25%)
- Electronic ID (10%)

Maturity of IT Diffusion

The data for this factor were obtained from EIU website. The index comprised of the following indicators:

- Broadband penetration (15%)
- Broadband quality (10%)
- Broadband affordability (10%)
- Mobile-phone penetration (15%)
- Mobile quality (10%)
- Internet user penetration (15%)
- International Internet bandwidth (10%)
- Internet security (15%)

Corruption Perception

The data for this factor were obtained from Transparency International website. This index is named perceived levels of corruption and is determined by expert assessments and opinion surveys. The scale of this index is 100 where 100 very clean and 0 highly corrupt.

4. ANALYSIS AND RESULTS

In order to get a better idea about the disparity of the data used in this study, a descriptive statistics was applied. The results are presented in Table 1. The results especially those of mean, standard deviation, and variance indicate that there are disparities among the countries in all variables. Moreover, from Table 1, the skewness and kurtosis measures show that the data of the variables used in this study are normally distributed. Normality is one of the assumptions that should be tested before running multivariate analysis. The results yielded in this table, ensure that other multivariate tests could be executed later. Besides, more information about the shape of the distribution could be found in the results. Most of the skewness values are negative which means that the mass of the distribution is concentrated to the right. At the same time, most of the kurtosis values are negative which means that the shape of the distribution is not peaked.

	N	Mean	Std. Dev.	Variance	Skewness	Kurtosis
Maturity of IT Diffusion	69	5.13	1.95	3.83	0.035	-1.442
Govt IT Policy	69	6.26	1.89	3.57	-0.085	-0.987
IT legal system	69	6.70	1.60	2.56	-0.627	-0.647
Digital Maturity	69	5.71	2.16	4.70	-0.091	-1.315
Corruption Perceptions	69	45.53	2.017	4.07	-0.257	-1.206

Table 1. Descriptive Statistics

The lower half of correlation matrix is shown in Table 2. By examining the bivariate correlation analysis, one can assess the relationship between different variables used in this study.

To assess the hypotheses presented earlier in the study, we used SmartPLS 3. The results are shown in Figure 2. The results of PLS analysis show that all the hypotheses are supported. All the coefficients displayed on the arrows are statistically significant at 0.001 level. The R-squared parameter measures the variance of endogenous latent variable that is explained by the independent latent variables. For this reason, R-squared is not computed for exogenous latent variables (IT legal environment and IT government policy).

	IT Diffusion	IT Policy	Capability of IT legal system	Digital Maturity
IT Government Policy	.861			
IT legal system	.804	.895		
Digital Maturity	.919	.941	.891	
Corruption perceptions	-.897	-.850	-.798	-.901

Table 2. Correlation Analysis

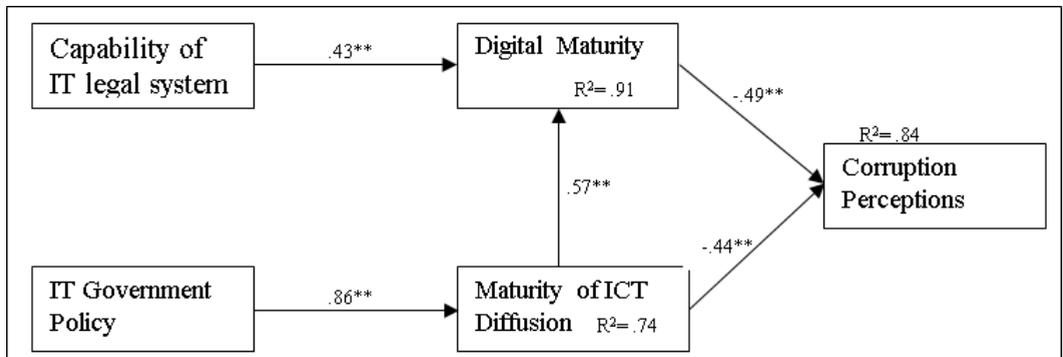


Figure 2. Results of PLS Analysis

Note: ** statistically significant at 0.001 level.

5. DISCUSSION

Now we briefly discuss the results of individual hypotheses. First, we posited that a higher level of digital maturity is negatively related to corruption perceptions. The digital maturity factor includes dimensions of consumer spending on ICT per head, level of e-business development, use of Internet by consumers assessing both the range of Internet features used by individuals and their online purchasing activity, and use of online public services by citizens and businesses. Digital transactions facilitate transparency and compliance, thus reducing corruption. The data used in this study confirmed a negative relationship between digital maturity and corruption perceptions.

Our second hypothesis avers that a higher level of maturity of ICT diffusion is related to greater digital maturity and lower perceptions of corruption. The

maturity of ICT diffusion factor includes dimensions of reach of Internet/broadband, affordability of Internet, quality of Internet, and security of Internet based applications. One can directly reason that the penetration of Internet technologies and affordability would result in greater number of people gaining access to ICT and its associated technologies. A greater level of confidence in security and quality is necessary before people gain confidence to conduct electronic transactions. An electronic transaction includes multiple sub-transactions among multiple players; therefore, it is necessary that the transaction is completed without interruption (Ahluwalia and Varshney, 2007). Security of transactions and personal information is also a major factor underlying users' trust in e-commerce, e-government, and similar applications (Bones et al., 2007; Albrechtsen, 2007; Flavian and Guinaliu, 2006). Clearly, a higher index of maturity of ICT diffusion means greater level of access to the interested users, higher trust and assurance in the technology which in-turn facilitates the use of various digital transactions and services. The data used in this study confirmed a negative relationship between maturity of ICT diffusion and corruption perceptions (H2.a) and a positive relationship between maturity of ICT diffusion and digital maturity (H2.b).

Our third hypothesis argues that the capability of the legal system to effectively deal with the issues relating to digital economy has a positive effect on digital maturity. We believe this is an essential condition for wide adoption of technology-based services by the people. The capability of IT legal system includes effectiveness of legal system, ease of starting a business, laws relevant to Internet based transactions, and sanctity of electronic identification. A mature legal environment assures people that in case of disputes or cheating, they can access appropriate forums for redressing and resolution of problems (Sitkin and Roth, 1993; Nickerson and zur Muehlen, 2006). An effective legal system is also required because of the delay between different steps in completing a transaction, specifically between making a payment and receipt of goods and services. Additional complexity arises because of locational separation between buyers and sellers. In traditional commerce, a purchaser can take touch and feel the product and can approach the seller instantly if there is a difference between the expected and actual product or service. Therefore, electronic transactions and e-markets require specific laws that can address the specificities involved in such

transactions. Thus, greater capability of IT legal system should lead to greater digital maturity of a country (H3). This hypothesis was supported by the data.

Our last hypothesis posits that government policies toward information technologies have a significant impact on maturity of ICT diffusion. The data support this relationship (H4). The maturity of ICT diffusion construct taps into adoption and diffusion measures of broadband Internet and Internet security. In the contemporary digital global economy, the implementation and execution of public policies are significantly influenced by ICT based applications (Bhattacharjee and Sanford, 2006; Stoica et al., 2005). IT is directly and indirectly contributing very significantly to the economic wellbeing of many countries (Van Dijk, 2003). Therefore, it is reasonable to expect that all governments would pay attention to the IT infrastructure in their countries. Just like most infrastructure areas, implementation of IT infrastructure is also expensive and does not ensure immediate return on investments thus hindering investments by the private sector. Even in developed countries, there are a few large players in this area. Thus, government's role in framing policies towards IT and even directly participating as a provider is common. This paper argues that higher level of government's role results in better IT infrastructure and access to ICT for the users. The data supports this hypothesis.

6. CONCLUSION AND IMPLICATIONS

This study proposes a model that specifies relationships between various macro-level IT related factors and corruption. Based on this model, the hypothesized relationships are confirmed using PLS analysis. This paper contributes to the literature in two important ways. Although existing literature includes papers that study the effects of country-factor on corruption, no study used comprehensive IT-related factors that influence corruption. This research addresses this issue and fills this gap by identifying four important higher order IT- related factors of country environments relevant to corruption. Second, while previous research has studied the effects of country-level factors on corruption, these studies have been limited by small sample sizes. Most of the studies on corruption studied one specific countries (Lee and Lio, 2016; Valle-Cruz et al., 2016). This study significantly extends the existing literature by using a larger data set thus overcoming a major limitation and improving generalization of the findings reported in this paper.

The findings of this paper offer important implications for policy makers. The model provides a diagnostic tool to the practitioners to find out which specific areas need more focus in fighting corruption. According to our study, policy makers need to consider their country's institutional and resource environments. For instance, when Internet-based applications and legal system do not invoke much trust of people, growth of e-commerce may be restricted and thus corruption remains high. To deal with this situation, policy makers may take specific actions to mitigate the effect of low trust of the people and organizations. For instance, they may improve the laws and its delivery system related to IT, invest more in infrastructure, and upgrade pertinent technologies such as Internet security. Such positive changes may mitigate the negative effect of low trust, increase citizens' confidence in ICTs in governments, and ultimately reduce corruption. The reason is because everything becomes traceable and transparent.

6.1 Limitations and Future Research

While this paper makes many significant contributions, a few limitations offer opportunities for further research on this important topic. Firstly, we used secondary data to assess the relationships. Although we ensured integrity of the data by using very credible sources, we were limited by the composition of the indexes that formed our higher order factors. Therefore, future research can consider the second order dimensions that formed the higher order factors. This would further improve the diagnostic value of the model proposed in the paper. In addition, as the Internet use continues to grow, the trends clearly are longitudinal. Therefore, a future research can also examine whether the relationships hold in a longitudinal examination.

Though this study used larger sample size than previous studies, still this sample size does not cover all the countries of the world; 69 countries were included. For future studies, using the raw variables that compose the indexes can also enrich the literature since it might yield fine-grained results, which will give practitioners as well as researchers more details about the factors that lead to fighting corruption. Another recommendation is to find data for more countries since not all countries were included in this study.

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