

Public Sector E-Innovations. The impact of e-government on corruption.

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Abstract

The paper aims at assessing innovations in the public sector, which were introduced by selected countries by 2009-2010 in the sphere of e-government, and the interrelation of e-government with corruption.

Although it is universally acknowledged that corruption is an evil, there is much debate over which determinants of corruption are important. Using statistical and econometric analysis for sizeable country samples the authors verified an inter-relation between individual and aggregated e-government and ICT development indicators, such as online services quality and ICT usage, on one hand, and the level of perceived public sector corruption, on the other hand. The major international rankings were analyzed, along with key policy documents and web-resources of the selected countries. A few country cases of geographically extensive states from different world regions with substantial powers delegated from the center to regions - Canada, the UK, Mexico and Russia - were selected to illustrate the findings.

In the conclusion the authors explore possible causal and dependency relations of the established interlink between e-government and public sector corruption. Suggestions for ways of advancing user-focused e-government practice are put forward, as well as recommendations for overcoming measurement constraints caused by the limited availability of internationally comparable data on the e-government demand-side.

INTRODUCTION

Corruption and its manifestations, such as administrative barriers, is a well-described barrier to advancing any innovations (OECD, 2010). Technological, process and organizational novelties introduced by government agencies, referred to as ‘innovations in the public sector’¹, are at the same time a solution to curb corruption and a very specific type of sectoral innovations.

Innovations in public services are widely viewed as necessary for improvement in performance and meeting the challenges of the budget constraints which many countries faced as a result of the economic downturn of 2008-2009. E-government² is one type of innovation in the public sector, which gained supporters among national governments and spread across economies at various stages of development. It is not only a way to make public services less expensive and more accessible, but is now viewed as underpinning innovation and change (OECD, 2009a: 24).

The rapid pace of technological development inspired the creation of increasingly advanced ICT solutions that are capable of radically transforming both public institutions and private organizations (Yigitcanlar, Baum, 2006). ICT offers tools for innovative interactions between a government and its citizens and smart ways to provide public services. Literature argues that e-government can bring the government closer to citizens, overcoming the hurdles of bureaucracy, curbing corruption and making decision-makers more responsive to people’s needs. The rationale behind its introduction, however, is most commonly that e-services are usually characterized by greater efficiency and transparency.

¹ The OECD defines innovation in the public sector as “new or significantly improved deliverables, ways of working or other initiatives that seek to improve or create new public sector activities”.

² The World Bank definition of e-government “refers to the use by government agencies of information technologies (such as Wide Area Networks, the Internet, and mobile computing) that have the ability to transform relations with citizens, businesses, and other arms of government”. The OECD also notes that the term “e-government” may be applied to the full range of government functions (OECD, 2002).

The New Public Management approach views citizens as customers (Boston et al., 1996; Kaboolian, 1998; Nagel, 1997). Certain countries have gone beyond this approach to treat citizens as partners in lay out, provision and evaluation of services. The presumption here is that greater efficiency in delivery of public services will depend on stronger collaborations with citizens and will result in reduction of costs, as well as savings of untapped resources, such as user time (OECD, 2009b). However, much of the theoretic results within the New Public Management school have been achieved at micro-level and very much rely on a national social, economic and political context (Pollitt, 1998: 65), for instance, changes at micro-level (i.e. specific changes in management practice) resulting in systemic changes in the public management. There were very few evaluations at macro level focusing on impact assessment (Jones et al, 2001).

This paper has the ambition to contribute to better understanding of the impact of specific public sector innovations (advancement of certain e-government aspects) upon greater, systemic changes (better control of corruption). The quantitative analysis below is made with sizeable country samples of 138 and 173 countries and illustrated with four country cases.

THE SCOPE AND METHODOLOGY

The study is aimed at assessing innovations in the public sector, which were introduced by selected countries by 2009-2010 in the sphere of e-government, and the interrelation of certain e-government aspects with control of corruption. Hypothesis of the study is that supply (e-government infrastructure) and demand sides (use of e-services by citizens and business) of e-government have an impact on good governance and corruption. Based on the study objectives, the following methodology was applied.

First a selection of countries was made for case studies, which serve as illustrations of existing practice in different regions throughout the text. Countries were chosen in a way to match the framework conditions, such as extended territory and federal setup (or unitary state with great regional autonomy); substantial national and cultural diversity. The selected countries are from different World regions that are at different stages in introducing e-government, including more advanced ones - Canada and the UK, as well as two less performing countries - Mexico and Russia (see Table 1).

Table 1. Features of selected countries.

Country/ feature	Continent	GDP per capita at current prices (2008 PPP US\$) *	Territory (sq. m)	Federal state/ regional autonomy	Ethnic and cultural diversity
Canada	North America	39,078	9,984,670	Federal state	Highest per capita immigration rate in the world; special autonomy to French-speaking provinces. As of 2007, almost one in five Canadians (19.8%) were foreign-born
Mexico	Latin America	14,570	1,964,375	Federal state	60% of the population was mestizo, 30% pure Amerindian, 9% pure white, and 1% other; Over 56 different indigenous groups
Russian Federation	Eurasia	15,923	17,098,242	Federal state	Over 160 ethnic groups and indigenous peoples
The United Kingdom	Europe	35,468	1,395,000	Unitary state with four countries	Increasingly ethnic diverse; England is the most ethnically diverse of all countries

Source: UN Human Development Indicators.

Secondly, major international ICT and e-government rankings were reviewed and analyzed. Selected indicators of these rankings, listed below, were identified for further use in statistical and econometric analysis.

Thirdly, to identify the link between ICT infrastructure and ICT use by citizens and business, on one hand, and perceived level of corruption, on the other hand, a correlation analysis was done for 138 countries and 4 aggregate indicators: the 3 sub-indexes of the WEF Networked Readiness Index (Dutta, Mia, 2011) and the Transparency International Corruption Perception Index (CPI, 2010).

Finally, to establish the relationship between public sector corruption and e-government use, the regression analysis was made for Transparency International Corruption Perceptions-index (CPI) for the year 2010 and United Nations' 2010 E-Government Survey-Index of Online Services (OSI) for a sample of 173 countries. In order to refine the analysis we made some cross-section estimates of corruption levels as measured by the Transparency International CPI-index in 2010 on measures for the quality of e-government implementation (OSI and EGOVRI), the Freedom House Political Freedom Index (POLFREE) (Freedom House, 2011) and the (log of) real GDP per capita in 2005 int. dollars. As a first attempt to reduce possible reverse causality problems, we regressed current CPI-levels in 2010 on OSI and EGOVRI-levels in 2005. To mitigate further the reverse impact of corruption on economic wealth and democratic freedom, we use the year 2000 levels of POLFREE and GDPpc. In the process of further refinement of methodology UN Telecommunications Infrastructure Index (INFRASTRUCTURE) was matched against the CPI.

The main data sources used in this study are single and composite indicators produced by the international governmental and non-governmental organizations that use them for international comparative studies in the sphere of ICT and e-governance. These sources have

reasonably up-to-date information, and time series. Authors concentrated on the 3 groups of indicators:

- E-government supply side: UN E-government Readiness Index and its subindexes: Online Services Index and Telecommunications Infrastructure Index (United Nations, 2010), WEF Networked Readiness Index (Dutta, Mia, 2011);
- E-government infrastructure: UN Online Services Index, WEF Networked Readiness Index; ITU ICT Development Index (ITU, 2010);
- Governance and corruption indicators: Transparency International Corruption Perception Index (CPI, 2010), Freedom House Political Freedom Index (Freedom House, 2011);
- Other variables: GDP per capita in int. dollars³.

To a large extent, the authors had to rely on existing measurement frameworks for a number of reasons. First of all, the desired individual indicators (i.e. the use of sophisticated e-services) were unavailable from open sources for countries outside EU and OECD. Secondly, these international organizations have advanced and sharpened their measurement methodologies over the past years.

For the selected country cases key policy documents and initiatives in the sphere of e-governance, as well as web-resources were also analyzed.

INTERNATIONAL MEASUREMENTS OF E-GOVERNMENT

The European Union (EU) has arguably advanced the most in forming its measurement framework for systematic gathering of performance information that can help identify and evaluate sources of effective and innovative e-governance practices. Since 2004

³ GDPpc from the Penn World Tables 7.0

Eurostat⁴ has been collecting statistical data on e-government usage by business and household (demand side), and consulting company Capgemini on behalf of the European Commission has since 2001 been collecting data on e-government service availability (supply side). More specifically, Eurostat's and other European Commission surveys of public services provide reliable data for the number of "basic public services" fully available on line; the share of individuals using the Internet for interacting with public authorities by purpose: obtaining information, obtaining forms, returning filled-in forms; the percentage of enterprises using the Internet for interacting with public authorities (by purpose) (European Commission, 2006).

The OECD is another international center, which advanced e-governance and, more generally, public innovation measurement. The task force of the OECD Group of National Experts on Science and Technology Indicators (NESTI)⁵ works on the metrics on public sector innovations, measuring performance, output or quality of public services, with a view to come up with the Guidelines on approaches to Public Sector and Service Innovation Measurement. The outcomes of this work are still not available.

Other international organizations, such as the International Telecommunication Union⁶, the World Bank⁷ and UN agencies⁸ study and promote e-governance as part of good governance and public sector innovations⁹. The aim is to root out inconsistency in definitions,

⁴ the Statistical Office of the European Community

⁵ Based on a proposal from the UK at the June 2009 NESTI meeting [see DSTI/EAS/STP/NESTI(2009)16] a Task Force was established including the following countries: Australia, Canada, Denmark, Finland, Iceland, Korea, Netherlands, Norway, Poland, Spain, Sweden, and the United Kingdom, with potential interest from France, Belgium, Italy and the United States.

⁶ Calculates ICT Development Index and gather most of the world statistics on ICT.

⁷ For example, the World Bank Group calculates its Governance Indicators and sustains its Information and Communications for Development Online Database.

⁸ For example, annual E-Government Readiness Report prepared by the UN Department of Economic and Social Affairs.

⁹ An international task force on e-government indicators was established in 2006 through the Partnership on Measuring ICT for Development, of which the United Nations Department of Economic and Social Affairs is a member. The task force will recommend a core set of measures to be collected by governments.

In May 2010 the OECD started discussions with the major global e-government survey owners, academic research groups and OECD member-states, and suggested launching new e-government indicators with a focus on public sector performance. E-government rankings have been calculated for over a decade and laying the

methodology, reporting and monitoring of e-government development across countries and levels of government, while supporting international benchmarking efforts.

Monitoring the efficacy of e-government development faces substantial challenges. Most of the statistics are derived from supply side indicators, sometimes by website assessments alone. Little data is yet available on the demand side of e-government. Few surveys exist that would indicate 'how' citizens appreciate and use these services and 'what' they see as maximizing public value. Measurement experts are to define the scope of governmental agencies, consider the issue of outsourced government functions, and accommodate heterogeneity among national and local institutions. The pace of technological innovation also needs to be taken into consideration when designing a framework for measuring e-government and monitoring its effects.

Taking into account the described limitations, a review of the latest editions of international rankings in the sphere of ICT, e-government and corruption is made below.

The E-government Development Index (EGDI)¹⁰ allows for a comparative performance assessment of national governments, although it is not intended for measuring the level of e-government in absolute sense (United Nations, 2010). One of the three EGDI components - Online Service Index (OSI) – measures the scope and quality of online services. It attempts to capture a country's performance in a single internationally-comparable value using a four-stage model of online service maturity: emerging, enhanced, transactional and connected services. It assesses the supply side: how useful are online services and how often

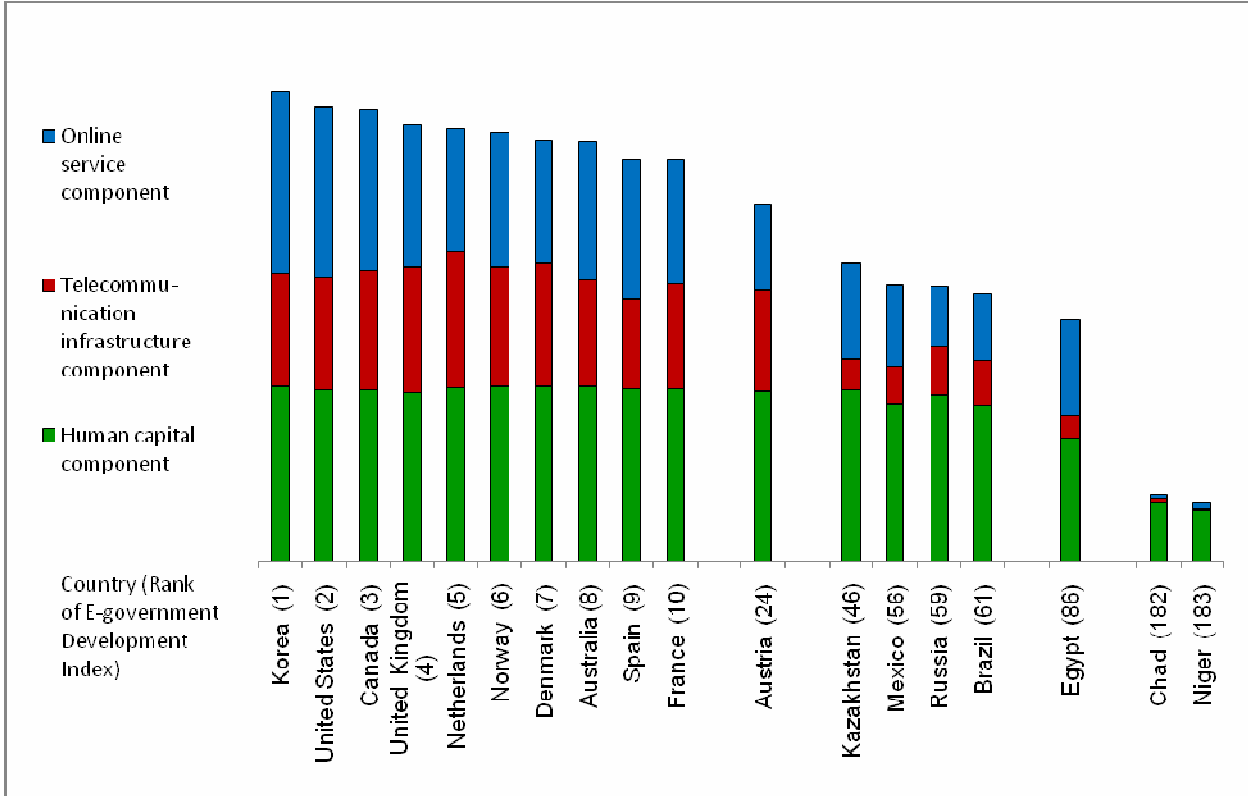
grounds for more advanced indicators, based on objective assessments (hard data). The idea is not to combine existing methodologies and indicators, but to develop completely new ones to be developed by a 'virtual taskforce'. The work will feed into the OECD's bi-annual report *Government at a Glance*⁹. Currently, the Report and its web-resource provides access to raw data, as well as composite indexes that regroup the key elements of public administration in human resource management, budgeting and regulation.

¹⁰ The maximum possible value of Index is one, the minimum is 0. The E-government Readiness measurement in EGDI is complemented by an E-participation Index. As of 2009-2010, in line with the updated methodology, EGDI consists of three subindexes: Online Service Index, Telecommunication Infrastructure Index and Human Capital Index. E-Participation Index attempts to bring some order to measurement of e-governance by positing the relevance of three factors in citizen engagement: electronic information dissemination, electronic consultation and electronic participation in decision-making.

they are provided to citizens. Within the OSI similar number of services provided through each country's national website as well as the websites of the ministries of education, labour, social services, health and finance were assessed.

While the second EGDI measure, Telecommunication Infrastructure Index¹¹, may be helpful in verification of our hypothesis, the Human Capital Index¹² is less relevant for a number of advanced countries, including countries in our case-study sample, like Canada, Russia, and the UK.

Figure 1. Ranking results E-government Development Index, 2010



Source: United Nations, 2010.

¹¹ The Telecommunication Infrastructure Index is a composite of 5 indicators that uses ITU primary data:

- PCs/100 inhabitants (Personal Computer Index),
- Internet users/100 inhabitants (Internet User Index),
- main (fixed) telephone lines/100 inhabitants (Telephone Line Index),
- cellular telephones/100 inhabitants (Mobile Subscription Index),
- broadbanding/100 inhabitants (Fixed Broadband Index).

¹² A composite of two indicators: Adult Literacy Rate and the Combined Primary, Secondary, and Tertiary Gross Enrollment Ratio. Adult literacy – 2/3, number of enrolled students -1/3.

The UN E-Government Survey is published annually as E-Government Readiness Report (United Nations, 2010). The 2010 Report covered 191 countries and ranked them by e-government readiness and e-participation. The top-5 countries are the developed countries: Republic of Korea, the United States, Canada, the United Kingdom and the Netherlands. Of the World regions EGDI regional average is highest for Europe. The national leaders in e-government within each World region were also pointed out. For example, in the Americas the top-ranked country is the United States, followed by Canada and Colombia; in Europe the top-ranked country is the United Kingdom. Russia was among the lowest-ranked of the 25 developing countries, which were assessed. Similar ranking for developing countries was done by indicator and Russia ranks lowest in EGDI Online Service subindex.

Looking at the demand side, the leaders in EGDI E-participation Index are Republic of Korea, Australia and Spain. Of the World regions E-participation index regional average is highest for Europe.

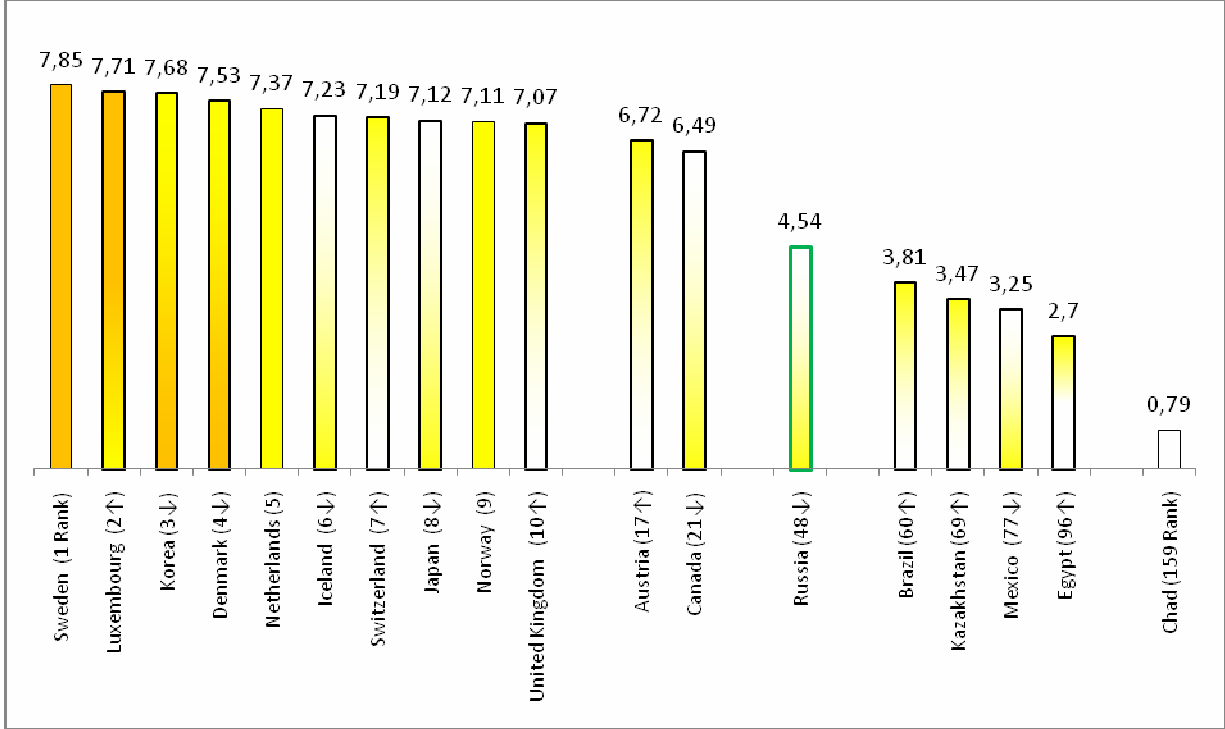
An astute analysis done in the UN E-Government Survey 2010 is an overview of e-features of selected crisis response web-sites (United Nations, 2010: 22-23). Of those surveyed, the best planned web-sites, from the viewpoint of e-governance objectives and tools are those of Australia, Canada, France, Spain and the United States (Recovery.gov).

Most international e-government surveys encompass various ICT measurements, as positive e-government developments are possible with a wide and universal ICT diffusion. Therefore, we looked into the level of ICT development in different countries around the globe as measured by the ICT Development Index¹³ (ITU, 2009; ITU, 2010).

¹³ ICT Development Index is composed of 11 indicators, grouped by the three sub-indices: ICT infrastructure and access, ICT use, and ICT skills. Sub-indices were computed by summing up the weighted values of the indicators included in the respective subgroup. After normalizing the data, the individual series were all rescaled to identical ranges, from 1-10. For the final index computation, the ICT access and ICT use sub-indices were given 40 per cent weight each, and the skills sub-index (based on proxy indicators) 20 per cent weight. The final index value was then computed by summing up the weighted sub-indices.

The latest results of ICT Development Index (IDI) published in 2010, testify to the remaining almost 10 fold sizeable gap in ICT development between high- and lower-income countries (ITU, 2010). The top ranking countries are Sweden, Luxemburg, Republic of Korea, Denmark, Netherlands, Iceland, Switzerland, Japan, Norway and Great Britain. All these countries, with the exception of two, are located in Europe, which is a leading region in the World in terms of ICT infrastructure and e-services. Of the selected countries Great Britain occupied 10th place in the final ranking, Canada ranked 21st, Mexico – 77th, and Russia - 48th.

Figure 2. Countries ranking by level of ICT development, 2010



Source: ITU, 2010.

The IDI sub-indexes allow revealing countries’ relative strengths. For instance, Russia is doing especially good in ICT Skills sub-index, while in ICT Use the country is far behind, ranking 59th, while in the level of access and use of ICT Russia comes only 45th and 59th respectively. It While Russia kept its positions in ICT skills sub-index, in two other sub-indexes the country gained 1 and 7 places respectively. Mexico has average scores in IDI sub-

indexes, while Canada occupies 18-22 places. Great Britain has the largest spread in IDI sub-indexes: ICT access – 9th rank, IDI use – 12th rank and IDI skills 31st.

The digital divide at international scale, illustrated above in ICT Development Index 2010 results, is a relative concept, which seeks to compare the level of ICT development in a country (group of countries) with that in another country (group) at a certain point in time. The digital divide may be defined as the relative difference in a measurement of a country's digital divide (i.e. by Orbicom Infostate Index), benchmarked against the simple average of all countries included in analysis (Orbicom, 2003). Above-average performing countries were assigned a positive number, and below-average performing countries were identified by a negative number. (ITU, 2010: 40).

The analysis of IDI 2010 results showed the prevailing, although slightly shrinking, digital divide between those countries with very high ICT levels and those with lower levels. This may be partly explained by the decelerating of ICT growth in the most advanced countries. At the same time, the top ranking countries have been advancing at a high rate thus increasing the gap with those ranking lowest. Moreover, ICT indicators have a relatively short time lag as compared to other development indicators. This increases the probability for countries at the bottom of the scale to catch up relatively fast, under the condition of due policy attention to their ICT sectors (ITU, 2010: 42-43).

The wider introduction and use of ICT is influenced by the cost of ICT services. For assessing this factor a special measure – price basket of ICT services – was formed. The price basket provides information on the cost and affordability of ICT services in absolute values and as a percentage of income (GNI per capita). The ten countries and territories with most affordable prices of ICT services are Macao (China), Hong-Kong (China), Singapore, Kuwait, Luxemburg, USA, Denmark, Norway, Great Britain and Iceland. In this ranking Great Britain ranked 9th, Canada – 11th, Russia – 34th, and Mexico – 48th. The data testifies to a faster

spread and application of ICT in developed countries. It is probable that lowering of ICT service costs would allow for their wider application, thus bridging the digital divide between countries (ITU, 2010: 99-100).

Based on the above analysis, we may note that the top ten countries in E-government Development Index and ICT Development Index cover the same five: Republic of Korea, Denmark, Netherlands, Norway and Great Britain. We also note this tendency. Despite the fact that countries ranking high in ICT development are gradually losing their positions, they are gaining in e-government ranking. A possible explanation is that the digital divide between countries is reducing and the developing world is gaining better positions. It is also probable that in the areas of infrastructure and ICT skills the advanced countries are ready to pass on to the new level of communications, including the interaction between national governments and their citizens.

E-GOVERNMENT AND CORRUPTION: A CROSS-COUNTRY ANALYSIS

Results of a few evidence-based studies suggest that corruption is linked with federalism and decentralization, which made the rationale for taking up four federal (decentralized) states for qualitative illustrations of econometric and statistical analysis presented in this paper. For instance, researchers attempted to prove that federal states were more "corrupt": while the current degree of democracy was not significant, long exposure to democracy predicted lower corruption (Treisman, 2000). Others stated that market decentralisation is associated with lower corruption, while the constitutional decentralisation (federalism) is, on the contrary, associated with higher corruption. Importantly, different types of decentralization have differential effects on corruption (Fisman, Gatti, 2002). Although certain forms of political decentralisation worsen the positive effect of constitutional

centralization on corruption, spatial decentralisation does not appear to have a strong association with corruption (Freille et al., 2008).

The federal states, such as Russia and Mexico, as well as countries with vast subsidiarity traditions, such as Canada and the UK, find it important to extend e-government authority from central to sub-national level¹⁴. Extending e-government to sub-national level is also of great importance to countries with vast and hard-to-reach territories, such as Canada and Russia.

The global economic crisis became a challenge for e-government. The crisis has not only increased national budget deficits, but also deficits of sub-national governments: while tax revenues plummeted, demand for social welfare grew (among other factors, related to unemployment). The financial difficulties of sub-national administrations will most likely affect the regular ways of delivery of public goods and services¹⁵. Moreover, in countries with substantial regional autonomy these difficulties may hamper the stimulus plans introduced at the national level (OECD 2009b: 25). The crisis challenge may turn out as an opportunity, creating a good stimulus for advancing e-government as a cheaper and more effective option for providing state services to people and businesses. For instance, here is a simple calculation of savings made with the introduction of the Canada's Government On-Line initiative. The average costs associated with transactions with the federal government are 30 Canadian dollars (CAD) per interaction in person; CAD20 per interaction by mail; CAD10 per interaction by telephone, and CAD1 or less per interaction via Internet (Government of Canada web-site, accessed 12 May 2011).

¹⁴ Subsidiarity is a principle, applied, among other areas, in governance and political science, according to which a central authority should be performing only those tasks which cannot be performed effectively at a more immediate or local level (The Oxford English Dictionary online).

¹⁵ On average, 56% of public investment is done by sub-national governments of developed states, and about 16% of their expenditures are linked with welfare services and transfers. To tackle existing and possible difficulties, central governments have introduced new discretionary, transitory mechanisms to facilitate coordination. In the sphere of public services these include, for instance, simplifying procedures and regulatory measures. Many of these innovative instruments appeared through regional development policy arrangements, which serve to prioritize public investment in regions through co-funding arrangements

Almost all OECD countries report that e-government may serve as a contribution to the economic recovery in 2009-2010, whether or not they have decided to include it as a formal part of their crisis response and recovery packages. According to an OECD survey, many of its member states have chosen to seize this occasion to accelerate the speed of its implementation (Ubaldi, 2011). Similarly, in early 2010, the United Nations published a global survey on leveraging e-Government at a time of financial and economic crisis. This went on to point to the importance of regulation and monitoring, restoring trust, moving from transparency to participation, data access and civil society, and improving international cooperation (United Nations, 2010).

Besides the recently unveiled economic crisis, a number of previously known risks are associated with the introduction of e-government, including information security issues (i.e. vulnerability to cyber attacks, which may lead to misuse of personal information); unwanted intrusion of governments into personal life of citizens; and the social exclusion caused by 'digital divide'. Both economically advanced and less advanced countries are prone to these risks. Being conscious of these risks, the authors deliberately decided not to address them in the paper, with the exception of the last one, which is analyzed and illustrated in the text with a few country examples.

'Digital divide' usually implies national or international patterns of unequal access to ICT. The term has received new, additional meanings since 1990s, and covers uneven access to primarily computers and the Internet based on income, ethnicity, geography, age, and skills or interest in using technology (Yigitcanlar, Baum, 2006). Therefore, countries with great ethnic, geographic and other forms of diversity, such as countries analyzed in greater detail in this paper, should pay greater attention to bridging the digital divide. This is especially

important if the countries are making efforts to introduce e-government, which requires all groups of population to have easy access to ICT and skills/ interest in using technology.

Discussion on bridging the digital divide is also important for our user-centric analysis of e-government from the perspective of strengthening the demand for e-government and inclusion of the excluded, i.e. new categories of users such as marginalized groups. The effects of digital divide on e-government and their interplay has been analyzed in detail by a number of researchers. The fact that e-government benefits may not be shared by the entire population downsizes its importance as a nation-wide governance tool. A digital divide, if it exists in society, restricts certain groups from using various e-government features due to limited access or skills. The study by Belanger and Carter explores the potential effects of the digital divide on e-government by surveying a diverse group of citizens to identify the demographic characteristics that impact use of e-government services. The results indicate that income, education, age and frequency of Internet use significantly impact the use of e-government services (Belanger, Carter, 2006).

The digital divide limitation to e-government is also related to underdeveloped ICT infrastructure in a country. Unavailability of required infrastructure to introduce sophisticated forms of e-government in developing countries is explored by Narayan in the study of e-governance and digital divide. In his paper Narayan argues that since developing countries have deeper telephonic/mobile than the internet penetration, the use of telephone/mobile as a tool to supplement e-government becomes imperative. The author introduces the term 'm-governance' to reflect this phenomenon, which may prove a good solution to bridge the digital divide in developing parts of the world (Narayan, 2007).

Bridging digital divide between developed and developing world is the tendency captured by the authors of the Global Information Technology Report (World Economic Forum, 2010). The tendency is noticeable in many African, Asian and Latin American

countries, which invest heavily in technology. Importantly, these investments have to be coupled with improvements in the regulatory environment and the related political and bureaucratic environment to support technology usage.

One of the ways to narrow the digital divide is to put more effort into providing training or low-cost PCs for people who are missing out on the internet experience. Since as of today the sizeable minority of population (i.e. poor and elderly) cannot interact with their government via Internet, electronic services should compliment and neither replace existing channels, nor cut back on other forms of service delivery (Silicon.com, 2005).

The digital divide is also noticeable in economically advanced countries, such as the European Union member-states, in some of which the governmental services supply does not fully match the demand. The Online Availability and Interactivity of Public Services indicator, calculated by Eurostat (Eurostat Information Society Statistics Database, data for 2009, accessed 4 April 2011), reached 100% in six EU member-states: Austria, Ireland, Italy, Malta, Portugal, and Sweden. This means that the governments supply all their services to citizens and businesses electronically.

At the same time, the EU countries leading in demand, i.e. have the greatest share of individuals and enterprises using the Internet for interacting with public authorities, are not the ones listed above and leading in supply (with the exception of Sweden). In 2009 they were Denmark, Finland, Iceland, Luxemburg, Netherlands, Norway and Sweden. The growing demand trend in these countries continued in 2010¹⁶. However, the leaders in demand perform relatively modest, compared to the EU leaders, on the supply side: Finland at 89%, Denmark at 84%, Norway at 80%, Netherlands at 79%, and Luxemburg at 68%¹⁷.

¹⁶ On indicator "Individuals using the Internet for interacting with public authorities" (2009): Island (80%), Norway (74%), Denmark (73%), Luxemburg (66%), Sweden (65%).

On Indicator "Enterprises using the Internet for interacting with public authorities" (2010): Finland (96%), Lithuania and Netherlands (95%), Denmark (92%), Luxemburg, Sweden (90%).

¹⁷ With the exception of Sweden where demand and supply tend to conjunct.

The demand-side of e-government is usually least advanced in terms of measurement methodology and practice, while essential for understanding the trends and identifying policy options. National surveys are a tool for governments that allow measuring the real demand and the level of customer (user) satisfaction. The United Kingdom is one of the EU countries, which has suffered from low adoption of, and satisfaction with, e-government. In a national citizen survey (2007), 41% of respondents responded that they had already used e-government. Only 19%, however, were of opinion that their government had been performing at “good” or “excellent” levels in this area (OECD 2009a). At the same time, the demand-side is often the only possible entry point of surveys assessing public sector corruption.

As it becomes clear with the international rankings and the status of our sample countries on them, there are many features and functional components of e-government, and countries differ in their preference towards particular components, such as e-infrastructure, e-services, and access to public information, all of which have a rationale for an anti-corruption effect. Among the debated arguments are that e-government may help increase the transparency of procurements system, make public services more accessible and transparent, and ensure a universal citizens’ access to information.

Internet-based government procurements system is viewed by some governments as an important tool in containing public sector corruption. This system may contain the legal framework, bidding opportunities, statistics, notifications and other relevant information. An Internet - based government procurement system (Compranet) was set up by the Mexico’s General Comptroller in 1996 (SECODAM, the actual Ministry of Public Administration). Another portal in Mexico is the purchase and expenditures portal of Social Security Institute (IMSS) making purchases of goods and services for the Mexican government for over USD 3 billion each year (OECD, 2005: 119).

Ensuring easy citizen e-access to government information is another important good governance tool in ensuring the execution of state obligations and raising the accountability to citizens. Information allows the society to know, assess and demand the improvement of government performance on issues of social importance such as public safety, education, healthcare and more. For instance, Canada's pro-active information disclosure policy cover disclosure of travel and hospitality expenses, disclosure of contacts, disclosure of grant and contribution awards and disclosure of information founded on wrongdoing. Undoubtedly close public scrutiny limits public sector corruption.

The quality and scope of various national ministries' web-sites may differ greatly even in one country. Moreover, the e-government services could be scattered across Internet, making user loose time in searching for a required service and learning the different operating systems. Therefore, it is preferable that national government agencies present their services in one common web-portal that serves as a single entry point for citizens. The practical steps in this direction include undertaking an audit of existing governmental web-sites, which should contain a joint national "one-window" online multifunctional service center; a clearly noticeable link/banner to e-government; and a database with regulatory and legal documents with a simple search engine, etc. An example here is Direct.gov in the UK, which brings together public services across 11 government departments (UK Cabinet Office, 2007). Another example is Canada's Government On-Line (GOL) brings together 130 services offered by over 30 departments and agencies. Russia is making steps in developing a unified portal gosuslugi.ru for provision of information on services, which are increasingly becoming available in electronic form. A good diversity and variety of services could be found at the Mexico's web-portal with more than 1500 information and transaction sources from over 100 government institutions round the clock (OECD, 2005: 119).

Sophisticated e-services, such as electronic tax declaration system, is usually made available to citizens in developed countries, such as Canada, where 48% of the services provided by Canada's Government On-Line are informational, 52% are transactional and 35% of the services are completed. However, it is increasingly available in less advanced countries, like Brazil. In 2011 Russia also launched the Internet portal for e-relations between citizens and Federal Tax Inspection with basic 18 e-services; interactive services are planned for 2012.

It is not enough to provide a vast range of services and structure them well by type and by user group. When e-services are multiple they need to be structured in user-focused packages, targeting specific user groups. Moreover, electronic document management systems, computerized processes and online databases also matter for advancing internal management at government agencies and in inter-agency interaction.

A vital, if not the central motivation to implement e-government applications is to improve the quality of public services. This overall goal includes a number of very different improvements, all of which are related to curbing public sector corruption. They range from a faster delivery of certain services (e.g. licenses or permissions) to citizens, better access to public information and information exchange procedures, to cost savings in the government sector. In general, the relation between input and output/outcome of public service supply should be improved by a more efficient government management, i.e. with the use of technological public sector innovations, such as e-government applications.

For over ten years preceding 2009 OECD observed a limited impact of government investments in developing and implementing e-government services. It was probably by the mid-2000s that governments in a number of wealthy countries refined their focus on user needs and assessing user satisfaction with public service delivery (OECD, 2009a). However bureaucratic barriers still hinder the adoption of a consistent and unified position, aligned among all government agencies (whole-of-government approach) to service delivery

(Christensen and Lægreid, 2006; Halligan, 2006). This approach requires a balance between efficiency and effectiveness, service quality and speed of delivery, user-friendly procedures and budget constraints. To make an example, whole-of-government approach is one of the two grounding principles of the Canada's GOL initiative, and implies provision of the entire range of government services regardless of what channel is used or which department, agency, or level of government is responsible for the service.

A vast range of structured good quality services should also be easily accessible and their provision should be made in a transparent manner. Greater accessibility and transparency of public services brought by e-government should lead to higher user satisfaction, and satisfied citizens enjoy higher quality of life. When opting for e-enabled channels, citizens expect and perceive certain advantages; they feel that they save time, gain flexibility, get a faster service/reply, get more and better information, get better help, feel more in control and save money. In an EU survey of importance of benefits for citizens (Rambøll, 2004), the 2 mostly valued benefits were the first two of these - timesaving and flexibility (Wauters, Lörincz, 2008).

Effective and efficient e-government may indeed produce desirable effects on the overall social and economic situation in a country. The authors' hypothesis, tested in the paper, is an effect of e-government on corruption control. The main notion behind the hypothesis is that bureaucratic discretion will be reduced through higher decision making transparency and information openness attained by standardized rules and procedures. Automated processes should limit opportunities of government employees to extort money from citizens. Information delivered to citizens in a more timely manner is expected to increase the transparency of government and empower citizens to monitor government performance more effectively. Moreover, a reduction of personal interactions between public employees and citizens may also contribute to a reduction in the number of corrupt

transactions (e.g. Bhatnagar, 2003; Clift, 2004; Andersen, 2009; Kim et al., 2009; Shim, Eom, 2009; Garcia-Murillo, 2010).

To prove the interlink between ICT infrastructure and ICT use, on one hand, and perceived level of public sector corruption, on the other hand, we performed a statistical correlation analysis of the Transparency International Corruption Perception Index (CPI, 2010) and the WEF Networked Readiness Index (Dutta, Mia, 2011) 3 sub-indexes: infrastructure environment, individual ICT usage and business ICT usage¹⁸. The choice of indexes was based on availability of comparable data on indicators, characterizing advancement of e-government in a sizeable sample of countries around the world. Figures 3.1-3.3 illustrate the distribution of 138 countries by CPI and the NRI subindexes.

Figures 3.1-3.3. Distribution of countries by CPI ranking and 3 subindexes of WEF Networked Readiness Index, characterizing ICT infrastructure, individual and business usage of ICT

Figure 3.1

Figure 3.2

¹⁸ The subindexes are calculated as follows:

- Infrastructure environment (Number of telephone lines, Mobile network coverage rate, Secure Internet servers, International Internet bandwidth, Electricity production, Tertiary education enrollment rate, Quality of scientific research institutions, Availability of scientists and engineers, Local availability of specialized research and training services, Accessibility of digital content).
- Individual usage (Mobile telephone subscriptions, Cellular subscriptions with data access, Households with a personal computer, Broadband Internet subscribers, Internet users, Internet access in schools, Use of virtual social networks, Impact of ICT on access to basic services).
- Business usage (Firm-level technology absorption, Capacity for innovation, Extent of business Internet use, Local office patent applications, Patent Cooperation Treaty applications, High-tech exports, Impact of ICT on new services and products, Impact of ICT on new organizational models).

For details see: <http://reports.weforum.org/global-information-technology-report/>.

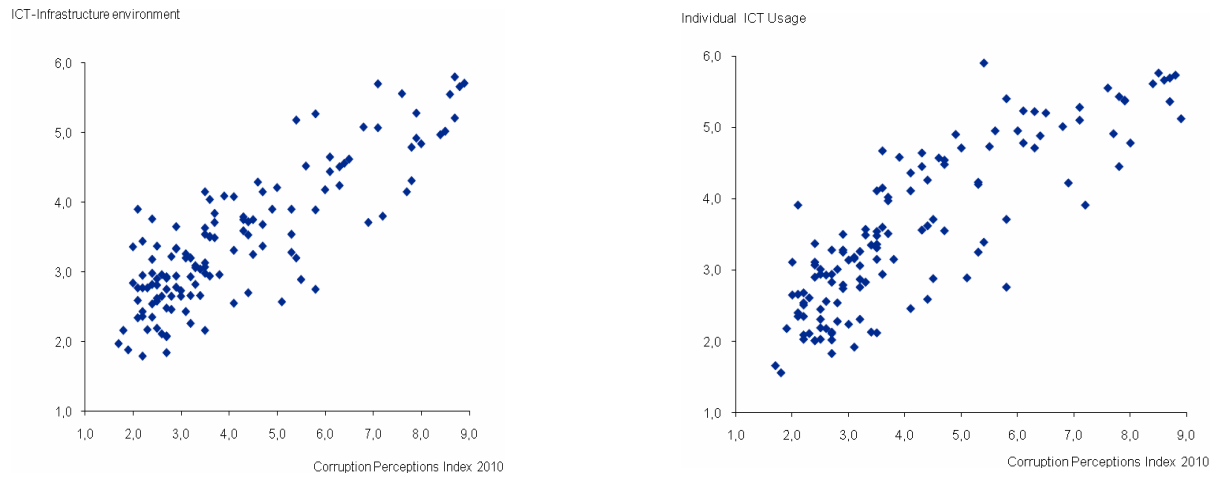
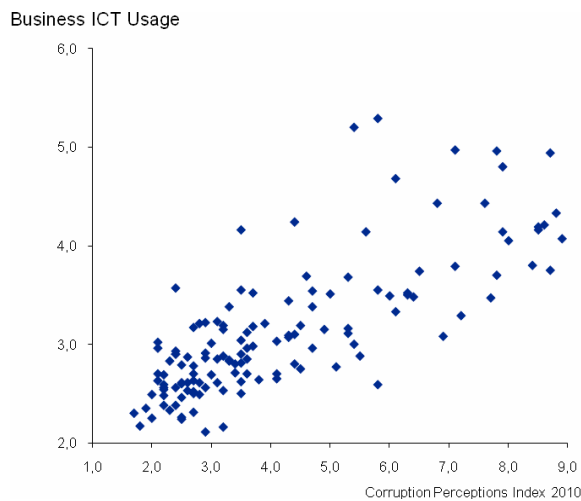


Figure 3.3



Sources: data from Dutta, Mia, 2011; CPI 2010.

The analysis shows a rather close linkage between the four composite indicators. Of the 20 top ranking countries in WEF NRI infrastructure environment, individual usage and business usage, 14, 15 and 13, accordingly, were among the top 20 in CPI. The 20 countries with highest level of corruption perception, 10, 8 and 9, accordingly, are the lowest ranking in the WEF NRI subindexes under consideration.

The closest connection was established between the level of corruption perception and infrastructure environment and individual ICT usage with the correlation coefficient 0,87 (see Table 2).

Table 2. Correlation coefficients between WEF NRI subindexes (2010-2011) and CPI (2010), 138 countries

	WEF NRI Infrastructure environment subindex	WEF NRI Individual usage subindex	WEF NRI Business usage subindex
Corruption Perceptions Index 2010	0,87	0,87	0,80

These results are an important step in proving an interlink between the level of ICT development, especially on the user side, with perceived level of public sector corruption. Clearly, ICT is the necessary precondition for e-government and the source of public sector technological innovations. At the same time the ICT infrastructure and usage indicators may only serve as proxy of the level of e-government advancement.

The Eurostat data allows us matching demand for public e-services and perceived corruption. However, data for a greater country sample was only available from aggregate indicators of international rankings.

According to the CPI the three best performing countries in 2010 were Denmark, New Zealand and Singapore. The EU members-states, which rank high by demand of public e-services indicator¹⁹ - Denmark, Finland, Norway, Netherlands and Sweden - also listed among the top ten in CPI. Of our country selection, we find Canada ranking 6th, followed by the UK, which occupies the 20th position, while Mexico and Russia are way below (see Table 3).

Table 3. Ranking of selected countries in CPI 2010

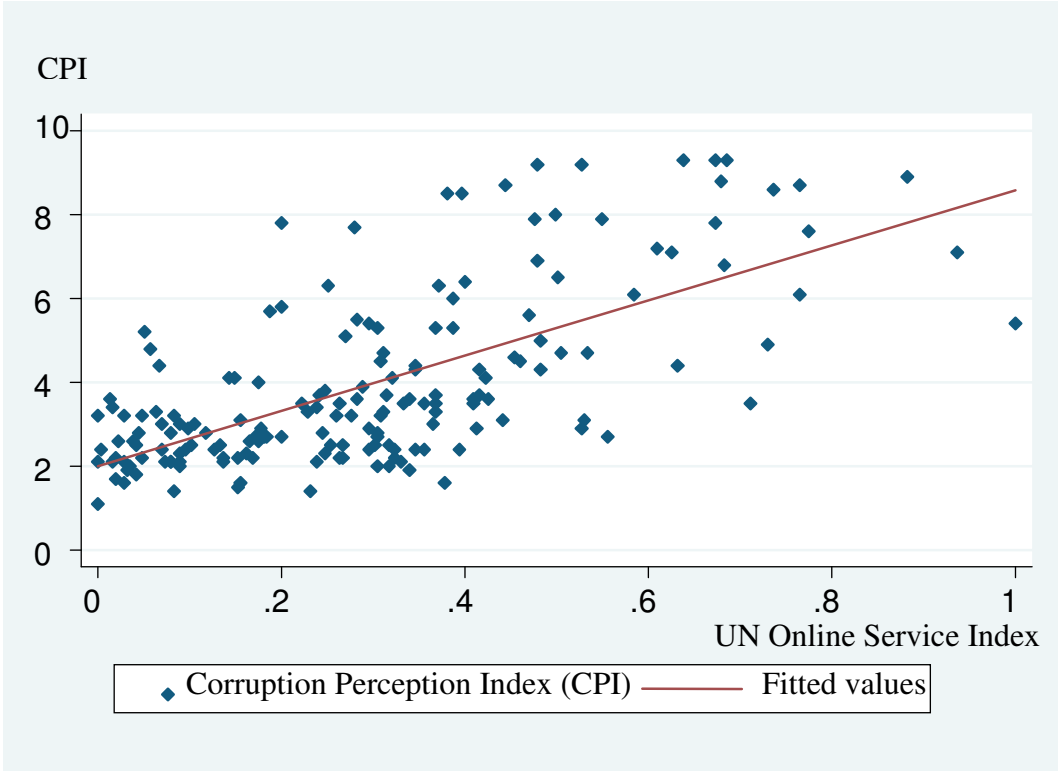
Country	Ranking
Canada	6
The United Kingdom	20
Mexico	98
Russian Federation	154

Source: data from CPI, 2010.

¹⁹ Share of enterprises and individuals using Internet for interacting with public authorities.

To advance and substantiate our analysis of the possible relationship between public sector corruption and e-government use, figure 4 plots the Transparency International Corruption Perception Index for the year 2010 against United Nations' 2010 E-Government Readiness Index of online services for a sample of 173 countries. The CPI measures the perceived levels of public sector corruption based on a number of different sources. The CPI lies in a range from 0 to 10, higher values indicating less corruption. The UN online service-index (OSI) attempts to capture a country's e-government performance using a four-stage model of online service maturity. It thereby takes into account the degree of user-friendliness and the amount of content offered on the government websites, following a 'citizen-centered approach'. The online service index is standardized on a 0-1-scale. Higher index scores illustrate more sophisticated and user-friendly services.

Figure 4. Online Service Quality and Corruption, 2010



Sources: data from United Nations, 2010; CPI 2010.

Figure 4 shows a highly significant relation between online service qualities on the one hand and perceived corruption levels on the other. Improved e-government services are

associated with higher CPI-levels and, thus, lower perceived levels of public sector corruption.

A simple bi-variate OLS regression describes the relationship between CPI-level and Online Service Index (OSI) by (p-values in parentheses)

$$CPI_i = 2.0 (0.000) + 6.6 (0.000) \cdot OSI_i, \quad R^2 = 0.45$$

These results are in line with our hypothesis about e-government mitigating corruption, but they are hardly definitive. The highly significant positive correlation does not imply causality; either of the parameters could be the independent variable influencing the other; they might be linked in a virtuous circle; or both could be (more or less independent) products of some unmeasured structural features. The possible relations here may be explored further, for example, that higher corruption levels per se could well be a decisive factor for worse online service quality. If government officials are responsible for the implementation of e-government, we should expect such a positive correlation between CPI and OSI, as corrupt officials tend not to introduce technologies that they might expect to reduce their discretionary freedom. At best, we would suppose them to introduce bad and ineffectual e-government services, which will weaken or even destroy the link between service quality and corruption levels”.

Further problems arise if we take into account that both public sector corruption and e-government implementation almost certainly depend on the level of democracy and the income level. Less democratic regimes are usually also more corrupt *and* are probably also less inclined to implement new technologies for improved communication with their citizens. Hence, a lower level of democracy will be associated with both more corruption and worse e-government services. Moreover, we would expect predominantly rich countries to provide the necessary telecommunications infrastructure which is a prerequisite for the introduction of online services. A country's economic wealth will therefore almost certainly play a decisive

role for the implementation of e-government. Finally, the quality of human capital, as measured by adult literacy rate or schooling level, will also be a determinant for the use of the internet in general and in particular for the implementation of the government online services (and their utilization). Both variables are commonly associated GDP per capita, which, however, may in turn be influenced by corruption levels.

Indeed the empirical literature on the determinants of e-government implementation shows clear associations in line with this discussion. In a large cross-country sample, Kim (2007) finds a positive relation of education level, economic wealth, urbanization rate, civil liberties and government effectiveness to e-government performance. These results are very much in line with the works of Chinn and Fairlie (2007), who examine the determinants of global computer use and internet penetration patterns. This is exactly what we would expect: factors that are supposed to be conducive to the world-wide spread of the internet use are also conducive to the implementation of e-government services. Most recently, Bussell (2011) finds that the adoption of e-government technologies depends on initial corruption levels. Politicians in countries with established high corruption are more likely to resist to the introduction of e-government services.

Hence, when testing the relationship between corruption and the use of e-government we observe a number of considerable and complex reverse causality and endogeneity problems. In this context, simple OLS estimates of the relationship between current corruption levels and online services will be biased even if additional controls are added to the specification. Thus, we switch to multivariate analysis - to Two-Stage-least-Squares (2-SLS)-regressions, looking for instrument variables that are on the one hand strongly related to the adaptation of high-quality e-government, and, on the other, not related to corruption levels (e.g. Wooldridge, 2005, ch. 15).

Table 4 displays the results of some cross-section estimates of corruption levels as measured by the Transparency International CPI-index in 2010 on measures for the quality of e-government implementation in 2005, as well as the 10-year-lagged values of the Freedom House Political Freedom Index (POLFREE, re-coded on a 0-10-scale, with higher values showing more political liberties) and the (log of) real GDP per capita (in 2005 int. dollars (from the Penn World Tables 7.0).

Table 4. E-government services as determinants of corruption

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	2SLS	2SLS	2SLS
OSI (t-5)	2.33 (0.001)		-0.37 (0.472)	-1.16 (0.223)		-2.88 (0.001)
EGOVRI (t-5)		4.84 (0.000)			-2.55 (0.257)	
GDPpc (t-10)	0.61 (0.000)	0.39 (0.001)	0.20 (0.008)	0.96 (0.000)	1.08 (0.000)	0.29 (0.000)
POLFREE (t-10)	0.11 (0.000)	0.09 (0.004)	0.05 (0.058)	0.18 (0.000)	0.19 (0.000)	0.07 (0.010)
INFRASTRUCTURE (t-5)			7.44 (0.000)			9.22 (0.000)
Constant	-2.55 (0.024)	-1.89 (0.012)	0.84 (0.090)	-4.65 (0.000)	-5.04 (0.001)	0.53 (0.305)
Observations	170	170	170	170	170	170
R2 (adj.)	0.638	0.676	0.802	0.544	0.489	0.765
First stage regression:						
	Partial R2 of excluded instrument			0.296	0.138	0.306
	F-stat.			71.86	24.11	60.94

Note: Robust p-values (two-tailed-tests) in parentheses.

Dependent variable: Transparency International Corruption Perceptions Index (2010).

Endogeneous variables: OSI (eq. 4 and 6) and EGOVRI (eq. 5). Excluded instrument: (log of) population size (in 1,000) in 2000.

Sources: data from

We use two different measures of e-government quality. The index for "online service" (OSI) is measured as described above, to account for the degree of user-friendliness and the amount of content offered on the government websites. The "e-government readiness" index (EGOVRI), also from the United Nations (2010), additionally takes into account the quality of a country's telecommunication infrastructure and its human capital (school

enrollment and adult literacy). EGOVRI therefore provides a more comprehensive picture of e-government availability.

As a first attempt to reduce possible reverse causality problems, we regressed current CPI-levels in 2010 on OSI and EGOVRI-levels in 2005. This is similar to say that the quality of services has an impact on subsequent corruption levels, less on contemporary corruption. A lag of 5 years is justified further by the fact that the impact of better e-government service availability on corruption does usually not lead to an immediate reaction of perceived corruption. To mitigate further the reverse impact of corruption on economic wealth and democratic freedom, we use the year 2000 levels of POLFREE and GDPpc. Results are qualitatively and quantitatively almost unchanged if we use the 2005 values of POLFREE and GDPpc.

Columns (1) and (2) show results of simple OLS estimates. Both Online Service Index (OSI) and e-Government Readiness Index (EGOVRI) in the year 2005 have a positive and significant relation to the Corruption Perceptions Index (CPI) in 2010. Better services are therefore associated with less corruption. EGOVRI includes measures for telecom infrastructure quality as well as human capital. The coefficient (+4.84) is more than twice as high as the coefficient of OSI (+2.33). This results points to the high relevance of a good infrastructure. In order to separate these effects, we simply added in columns (3) the UN Telecommunications Infrastructure Index (United Nations, 2010) as an additional infrastructure variable to the OSI-base equation (1). INFRASTRUCTURE is coded on a 0-1-scale, higher values reflecting better infrastructure. While the INFRASTRUCTURE index (for the year 2005) is highly significant and positively related to the CPI, the OSI loses its positive relationship to the CPI. This is partly due to collinearity, but it may also show that an extremely high relation of EGOVRI to the CPI is driven primarily by infrastructure quality and not by the quality of provided online services.

In equations (4) to (6) we re-estimated (1) – (3) by 2SLS, and modeled the e-government variables OSI and EGOVRI as endogenous. We only used one excluded instrument, i.e. the (log of) population size in the year 2000. There is no reason to believe that population size and corruption levels are systematically related. A simple correlation test confirms this ($r = -0.12$). But we examine this variable because it could be argued that adoption of e-government online services is especially helpful in populous countries (because of the increasing returns to scale that could be expected). The first stage regressions clearly confirm this assumption. In all estimates the (logged) population variable is significant and positively related to the OSI. The partial R^2 of the excluded instrument is around 0.3 in (4) and (6) and still 0.14 in (5). F-test values above 10 are also an indication that the first stage instrument is valid. Using only one instrument and one endogenous variable, the equation is exactly identified.

The results show a somewhat different picture as compared to simple OLS. In (4) and (5) the e-government indicators are negatively related to the CPI, though the coefficients are not significant. Hence, there is no indication that the adoption of e-government services is related to a reduction in corruption levels. Adding the infrastructure control variable in (6), the coefficient of OSI even turns its sign and becomes negative at a 1 percent confidence level, while INFRASTRUCTURE is strongly positively related to the CPI. Again, this is an indication that not the introduction of online services but instead a better telecommunications infrastructure is associated with a better corruption performance.

Summing up, we find no stable relation between the quality of e-government services and the corruption level as measured by the Transparency International CPI measure.²⁰ We suspect that the often found positive relation between government adoption of e-services and corruption containment mainly works through the infrastructure channel. Hence, measures

²⁰ The results hold if we use the World Bank's "Control of Corruption" measure (data were available for 2009 instead of 2010).

that measure the quality of e-government services inclusive of infrastructure variables may lead to misleading results. The extremely optimistic view about the anti-corruption effects of e-government should be seen with more skepticism.

CONCLUSIONS AND OUTLOOK

Through our analysis we found out that a better ICT infrastructure, greater individual and business ICT usage are associated with better control of corruption, as perceived by citizens. The major conclusion is somewhat skeptical concerning the supposed anti-corruption effects of e-government. From cross-national analysis, we found no stable relation between the quality of e-government services and the corruption level as measured by the Transparency International CPI. Our suggestion is that the frequently established positive relation between government adoption of e-services and corruption containment mainly works through the infrastructure channel. According to the analysis of indicators presented in the paper, it is not the introduction of online services, but rather a better telecommunications and ICT infrastructure, as well as ICT usage that is associated with less corruption in governments as perceived by citizens.

As illustrated in our country cases, while some of the least advanced countries are still looking at e-government from a government-centric paradigm, some of the more advanced states have shifted to a citizen-centric perspective, placing greater attention on the framework conditions (e.g. organizational, institutional and social factors) in which e-government is developing, as well as on the outcomes for users.

Most of e-government aspects reviewed in the paper have direct implications for curbing corruption. Through the analysis of national policies and their implementation certain successful user-focused e-government programmes were identified. These include one-gate fully integrated portal that gives access to all on- and offline e-services, provided by various

national agencies; focus on user-groups in visual and technical design and implementation of e-services; allow for easy access to information and ensure full transparency of all government actions (i.a. through special e-procurement portals); constantly and creatively engage users in the e-government assessment and improvement.

An important pre-condition for a user-focused e-government is a built-in customer relationship management, which covers constant monitoring and other research of users' satisfaction and user needs. Other features which allow focusing on the user are the user-friendly web-interface that may be provided through a technological platform that enables interoperability and standardization across different government offices.

Our analysis of international rankings and individual indicators, available for some countries, testifies that the digital divide remains to be one of the major obstacles to the wide profusion of e-government not only in the developing world, but also in fast growing economies and in the economically advanced countries.

The possible future priorities for the development of e-government include an increase in the number of transactional services and further efforts to reinforce customer resource management. Some countries have already adopted a strategy geared toward the use of mobile technology in service delivery – we are now hearing of mobile government (m-government) and a wide spectrum of other non-Internet e-government technologies.

As we have seen in the paper, international organizations have developed various approaches to measurement of public sector innovations in the sphere of e-government and are constantly looking for ways to advance them. However, as it was shown, these metrics have their deficiencies. International rankings also face the challenge of taking into consideration the specific national features, while preserving cross-country comparability. Among the ways to overcome shortages of international measurements – popular rankings -

and specific indicators are better procedures for data collection from national sources and advancement of methodology to capture all aspects of e-government.

At present the international organizations, owners of ICT and e-government international rankings, make very little use of official statistics in certain countries and rely on own sources: expert assessments, databases, questionnaire surveys, own studies of national web-sites. These limitations may lead to incomplete and partial information, which, in turn, may lead to inconsistency of ranking studies results. For instance, due to difficulties with data collection, EGDI 2010 was not able to encompass such aspects as cross-country differences in user-friendly design of services for various population groups; and share of service requests processed electronically and online in the total number of requests. The low response rate of national partners in multinational comparative studies (i.e. approx. 30% in EGDI 2010 Online Service Index) lead to a number of challenges, including language, with assessing national sources centrally (i.e. official web-sites).

Additional incentives are needed for countries to introduce various e-government indicators in their statistical practice. For instance, the European Union has developed a benchmarking framework to track the progress towards its i2010 strategic goals. The sets of indicators, among other, cover availability and usage of online services by population and enterprises broken down by purpose, as well as issues of inclusion (computing disparity indices with household connectivity and usage indicators, e-accessibility, and measuring digital literacy). This may be considered as best practice.

Acronyms

CCTV - closed-circuit television

CPI – Transparency International Corruption Perception Index

EGDI – UN E-government Development Index

EGOVRI – UN E-Government Readiness Index

GOL – Canada's Government On-Line Initiative

ICT – Information and Communication Technologies
IDI - ICT Development Index of the International Telecommunication Union
ITU – International Telecommunication Union
NESTI – OECD Group of National Experts on Science and Technology Indicators
NRI - Network Readiness Index of the World Economic Forum and INSEAD Business School
OECD – Organization for Economic Cooperation and Development
OSI – EGDI Online Service Index
POLFREE - Freedom House Political Freedom Index
RFID - radio frequency identification
TI – Transparency International
UN – United Nations
WEF – World Economic Forum

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