E-Government as an anti-corruption strategy in EU countries

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Abstract
Governments around the world are recognizing the power of the use of information and communication technologies (ICT), the utilization of digitized inter-connective communication systems linking governmental organizations and its stakeholders. European Union's member countries have gone a long journey in this area in the last two decades. One of the consequences of the implementation of ICT in public administration is also the restriction of the public official´s discretion, thus also reduction of corruption in the public sector. This paper is focus on the potential impact of e-Government on the level of corruption in the European Union's member countries. Specifically, this paper examines the impact of the use of ICT represented by the E-government Development Index on the evaluation of the level of corruption in the public sector represented by the Corruption Perception Index in 28 member countries of the European Union.

Keywords: e-Government, e-Governance, Public Administration, Corruption, Public Services, e-service, European Union.

JEL Classification: H00, H11, H41, F60.

1. Introduction

Impact, especially of bureaucratic corruption, on the economic performance of countries has been a favourite topic of numerous studies and debates for decades. The strong interaction between politicians, officials and businessmen, aiming to obtain illegal economic rents from public activities characterizes in many countries the decision-making process on public investment and reduces their economic performance. According to numerous studies (Jain, 2001; Kimbro, 2002; Kim, 2007), corruption has exactly quantifiable negative impact on economic efficiency and economic growth of the state.

A feasible way to reduce corruption, especially in the public sector, may be reducing the interactions between officials and the public. This can be achieved by means of e-government. E-government can ensure not only providing more information to the public, but also remove the discretion of public officials (Mistry, 2012; Mistry, Jalal, 2012; Seo, Mehedi, 2016). European Union countries are very positively evaluated in terms of the implementation of information and communication technologies (ICT) in the field of public administration in recent times (United Nations, 2016).

The aim of this paper is to prove or disprove the relationship between the level of corruption and the degree of utilization of e-government in the European Union´s member countries. The paper observes the relationship between changes in the use of e-government and changes in the level of corruption in European countries during the period from 2003 to 2016.

1.1 Restriction of corruption through the implementation of information and communication technologies in the field of public administration

Transparency International (2016), international non-profit organization which function is to map the status of corruption and to contribute actively with its operation to corruption limitation, defines corruption similarly as *„misuse of a public function for the purpose of private enrichment".*

The corruption is often called as a „sand in wheels" of economies because of its negative economic consequences. The negative effects of corruption on foreign investment are shown by Shleifer and Vishny (1993). In addition, corruption increases transaction costs, impedes the development of a market economy, undermines the system of free markets by increasing the degree of uncertainty and reduces government revenues while raising its spending (Rose-Ackerman, Palifka 2016). Corruption leads also to a misallocation of resources, particularly when the investment of public funds and approval of private investments are decided not on the basis of economic or social value of a project, but rather on the potential revenue that public officials may expect to receive from their decisions (Jain, 2001).

Some studies identified the potential role of E-government in reducing corruption. E-government eliminates the scope for bribing by elimination of intermediary services and it allows for citizens to arrange their transactions by themselves (Singh, G. et al., 2010). Researches carried out that factors supporting corrupt practices in public administration officials, such as monopoly power, discretionary powers or lack of accountability are mitigated by the existence of a functioning legal system and greater transparency (Mistry, 2012). These studies agree that the increased use of E-government can weaken the factors causing corruption and result in a reduction of monopoly power by officials and ultimately lead to greater transparency in public administration functions (Kim, 2007; Mistry, 2012). Mentioned authors in principle agree that an important role in the anti-corruption strategies of individual states play is by providing easy access to information for all citizens through the use of e-government approaches and initiatives. This may result in greater transparency, which limits the possibility of a public official to accept or even demand a bribe.

1.1.1 The transition from the e-Government to the e-Governance

A massive use of ICT in public administration, public administration and communication with citizens has taken place over the last two decades not just in Europe. This is reflected in the way of how public services are provided. The United Kingdom, Netherlands, Estonia or the northern European countries have long been striving for the widest possible expansion of digital public services. Estonia is a well-known pioneer in e-elections. The way to use the electoral process with a digital ID chip is being used by Estonia till today. Some countries use ICT "only" to raise awareness of their citizens or deliver better quality public services. However, some countries are even further and thanks to ICT are their citizens directly involved in decision-making and control processes of public administration. Therefore, it is possible to distinguish the concepts of e-Government and e-Governance.

The concept of *e-Government* could be define as the use of ICT by public institutions to ensure the exchange of information with citizens, private organizations and other public institutions in order to increase the efficiency of the internal functioning and to provide fast, affordable and quality services (Lidinský, 2008). It should be added that ICT can significantly improve the quality of public services provided. The provided e-service is provided with the help of technology, the contact between the customer and the public administration is not face to face, the e-service is self-service, and there is no need for another person to perform the service. The *e-Governance* approach means the use of ICT in

public administration to improve the awareness and quality of public services by involving citizens in decision-making processes and by creating more responsible, transparent and efficient government (Budd, Harris, 2009). E-Governance is focused on democratic processes. The government as a co-ordinating body operates in a democratic system and citizens and other subjects follow their own interests and express their views in a formal system based on democratic principles. The schema of transition from e-Government to e-Governance with the fundamental characteristics and goals of each approach is depicts on the Figure 1.

Figure 1: The transition from e-Government to e-Governance
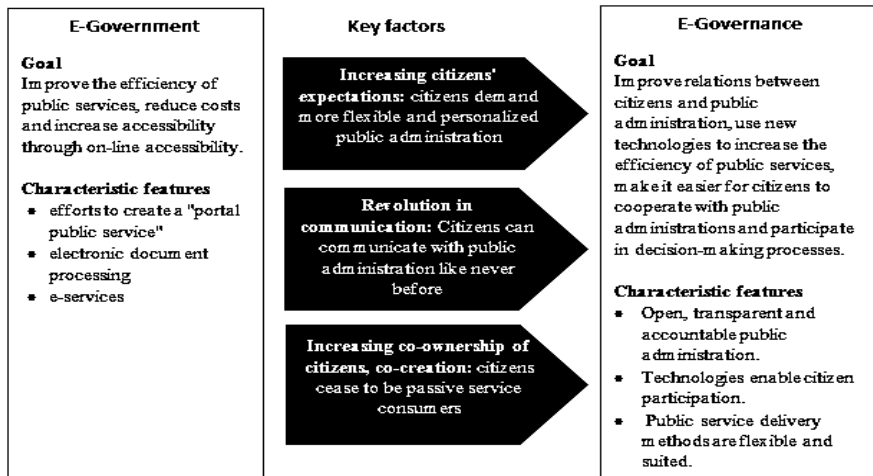
Source: own elaboration

European countries are developing a series of e-Government and e-Governance initiatives to develop public administration. E-Government initiatives support the delivery of e-services, e-Governments are geared towards the development of democratic dialogue between the government and the public, businesses and non-governmental organizations. Over the last decade, large EU funds have been devoted to e-Gov- projects, but many of these projects have been implemented only partially or not at all. Examples of the most common barriers to the practice of e-Gov- ideas are financial barriers, digital gaps, high IT access costs, insufficient IT education of inhabitants, information labyrinth or fear of data misuse (Oakley, 2002).

2. Problem Formulation and Methodology

In order to verify the existence of a relationship between the utilization rate of e-Government and level of Corruption, established indexes will be analyzed. Specifically, the E-government Development Index and Corruption Perception Index will be used. Analyzed time series is the period from 2003 to 2016. This is the longest time series, which could be analyzed. Year 2003 was the first and 2016 was the last year of calculation of the E-government Development Index, the indicator of the level of E-government in a country.

2.1 Model and Data

The Corruption Perception Index (CPI) has been published by Transparency International (TI) since 1995. It is an index that is based on corruption perceptions of respondents, which are domestic and foreign entrepreneurs, analysts and representatives of the professional

public in the evaluated countries. As a result, the CPI takes values in the interval from 0 to 100, where 0 is highly corrupt country and value of 100 indicates a country without corruption. The sample of examined countries is changed over time. For example, the index of 1995 included 41 countries, and in the last survey in 2016, there were already 176 countries evaluated (Transparency International, 2003, 2016).

The E-Government Development Index (EGDI) is used to estimate the level of E-government in a country. This measurement is based on a survey compiled in cooperation between United Nation´s Department of Economic and Social Affairs and Civic Resource Group, consulting firm providing technology solutions in the field of E-government. The EGDI reflects how a country uses an information technology to promote access and inclusion of her inhabitants. EGDI has been published since 2003 and takes values in the interval <0; 1>, where 1 represents the high level of usage of E-government and a value of 0 means a low rate of application of E-government in public administration. Of the 193 countries surveyed in 2016, the United Kingdom, followed by Australia and Korea, ranked first in the last rank of the EGDI. There are significant differences in average EGDI values across continents. The lowest value for the long-term is the average of the countries of the African continent (0.2882), while the highest is the average value of European countries (0.7241) (United Nations, 2003, 2016).

Verification of the relationship between E-government and corruption will be carried out by using a simple linear regression analysis and correlation coefficient. Correlations between defined variables will be verified by the value of the Spearman correlation coefficient ("the correlation coefficient"). The calculation of the correlation coefficient will be conducted by using statistical software STATISTICA, version 1.10. The significance level established for the correlation analysis is 0,05. The null hypothesis defines that the monitored variables are not in correlative relationship. Verification of this hypothesis is based on the subsequent comparison of the level of significance with a value (called p-value) which statistical software generates. Then we can also determine how tight the mutual correlation between the variables is. The correlation coefficient takes values between -1 and 1, inclusive. Values of the correlation coefficient close to value of -1, respectively 1, can describe a very strong mutual correlation relationship between the observed variables. It is also possible to distinguish the positive correlation relationship (or direct relationship) that occurs when the value of the correlation coefficient becomes positive. Or otherwise, we can specify a negative correlation relationship (or indirect relationship). First will be investigated relationship exists between EGDI and CPI in two-time periods (i.e. 2003-2016). Subsequently, analysis of whether there is a relationship between change in EGDI and change in CPI during the mentioned period will be done.

The following regression function was used to verify the relationship between the CPI and the EGDI. The function is based on the least squares method (Freund, Mohr, Wilson, 2010):

$$y = \alpha + \beta * x + \varepsilon \tag{1}$$

The parameter x denotes the independent variable, in this case the use of E-government (index EGDI) and the parameter y denotes the dependent variable, i.e. the level of corruption (CPI). The parameter α determines the distance of intersection of the regression line with the y-axis (the value of the regression function for x = 0). The parameter β is called the regression coefficient and shows the variation of the dependent variable value when the value of the independent variable changes. The symbol ε is the residual variance, which is a graphical representation of the distance of points from the regression line.

3. Problem Solution

Correlation coefficients for the variables are shown in the Table 1. The values identified using Statistica as statistically significant, are highlighted in bold. A positive correlation relationship was found among the variables CPI and EGDI in both years. There is a relationship between corruption and using E-government methods in the analyzed countries.

Table 1: Correlation matrix

| Variable	EGDI2003	EGDI2016	% change EGDI	CPI2003	CPI2016	% change CPI
EGDI2003	1,000000	**0,892045**	**-0,671026**	**0,861866**	**0,863523**	**-0,534131**
EGDI2016	**0,892045**	1,000000	-0,270675	**0,807577**	**0,796980**	**-0,541352**
% change EGDI	**-0,671026**	-0,270675	1,000000	**-0,511973**	**-0,528950**	0,255819
CPI2003	**0,861866**	**0,807577**	**-0,511973**	1,000000	**0,901920**	**-0,735140**
CPI2016	**0,863523**	**0,796980**	**-0,528950**	**0,901920**	1,000000	**-0,389711**
% change CPI	**-0,534131**	**-0,541352**	0,255819	**-0,735140**	**-0,389711**	1,000000

Source: own elaboration according to Transparency International (2003, 2016), United Nations (2003, 2016)

Bag plot was used for graphical interpretation of the examined variables. It is a generalized two-dimensional graph, which serves the graphic interpretation of statistical data. Points in the graph represent a combination of dependent and independent variables of individual countries. Dark -blue area (i.e. Bag) contains 50% of surveyed countries (between the first and third quartile) and dark- blue square represents the median value of the examined countries. Light blue exterior bag contains other rated states that achieved different values than countries in the dark blue field, but are not outliers. Outside of this area there are outliers that are shown in the chart with small stars. Bag plot also shows other characteristics of data displayed as the country's position within the evaluated countries, as well as the relationship between the evaluated variables indicated by the orientation of the bag (positive slope of bag indicates a positive relationship between the evaluated variables and negative slope of bag suggests the negative relationship).

Figure 1 shows bag plot of EU countries that use the data from 2003. On the x-axis there is the EGDI in 2003 and on the y-axis, there is the CPI in 2003. As mentioned earlier, higher values of the EGDI indicate better readiness to use IT technology in the field of public administration and higher CPI values indicate less corruption in the country. Slope of the bag plot confirms the positive relationship between analysed variables. The year 2003 showed the impact of E-government at the level of corruption of evaluated countries. The bag plot illustrates several outliers of remote countries that are out of the evaluation of others in terms of the use of E-government or the assessment of the extent of corruption. There is not any significant separation of any country from others despite of the occurrence of several outlying values.

Figure 2 shows the same bag plot using data of 2016. Bag plot values achieved a positive slope again, which confirms the positive relationship between the variables also for year 2016. There are again some outliers that are identified in terms of the extent of corruption and the level of E-government differs from other countries in its group. For example in previous text already mentioned United Kingdom, which has the highest ranking of EGDI 2016 of all 193 evaluated countries.

Figure 2: Bag plot 2003

Figure 3: Bag plot 2016
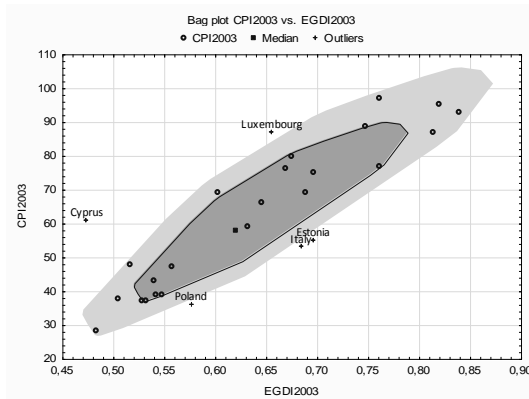
Source: own elaboration according to Transparency International (2003), United Nations (2003)
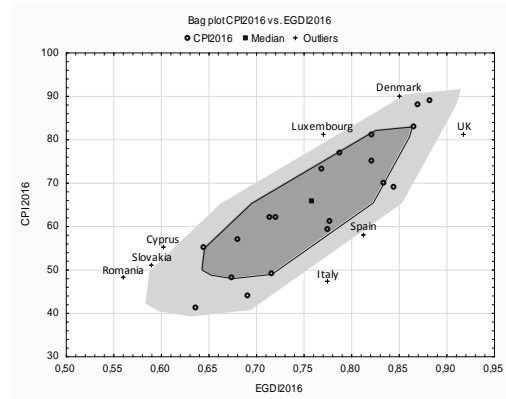
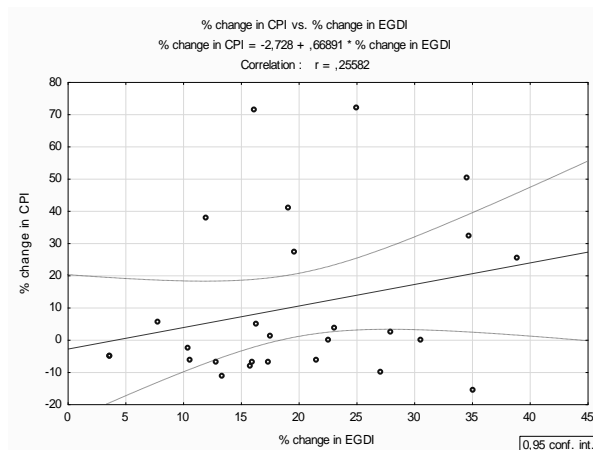Source: own elaboration according to Transparency International (2016), United Nations (2016)

Lithuania recorded the most significant progress in the use of E-government in public administration in the reporting period. In the analysed years, Lithuania reached the level of the index EGDI 0,557 in 2003 and 0,775 in 2016, which means an increase of 39% in the level of usage of E-government in the country. In that country also the level of corruption was decreased by more than 25%. Also Croatia achieved a significantly better evaluation in EGDI in 2016. This country reached almost 35% improvement in the level of usage of E-government and level of corruption decreased by 32 % as well. Therefore it is possible to observe the same direction of the development of the examined variables in analysed period in many EU member states. But it is worth to mention that CPI 2016 index ratings in some countries are worse, despite the positive development of the EGDI 2016 index. Thus, increased use of ICT has not led to a reduction in corruption rates in all countries. As already mentioned above, corruption is a complex issue, and its causes vary considerably in the countries of origin.

We can use the following regression model to estimate changes in the rates of induced change in E-governmet in the country (Freund, Mohr, Wilson, 2010):

$$\Delta\text{Corruption} = \alpha + \beta * \Delta\text{E-government} + \varepsilon \qquad (2)$$

Where ΔCorruption is the change of the Corruption Perception Index between 2003 and 2016, and ΔE-government is the change of the E-government Development Index in the same period.

Figure 3 is focused on how changes in the EGDI may affect changes in the CPI. Figure 3 shows the percentage change in the EGDI between 2003 and 2016 on the horizontal axis and the percentage change in the CPI between 2003 and 2016 on the vertical axis. This graph shows the evolution of the CPI and the EGDI during the sampling period. The linear regression line shows that not all countries with raised value of the EGDI recorded also simultaneously decrease of corruption. However, the linear regression line still has a slightly positive slope. It can be concluded that at constant conditions and other variables results with a one percent change in the index EGDI nearly 0.67% change in the CPI countries occurs in analysed period. In other words, improvement in the assessment of E-government in the country by 1%, leaded to the improvement of corruption in the country by almost 0.67 % in analysed group of countries.

Figure 3: Linear regression model for variables change in years 2003-2016

Source: own elaboration according to Transparency International (2003, 2016), United Nations (2003, 2016)

4. Conclusion

The goal of this paper was to examine the existence of relationship between the corruption and usage of ICT and find an answer for the question, if changes in the utilization of these technologies lead to changes in the level of corruption in the EU member countries. For verification of this relationship, defined hypothesis which truth was confirmed by empirical models were stated. The positive impact of the E-government in reducing corruption in most of the countries was confirmed by using correlation and regression analysis. It has been shown that 1% percent increase in the index EGDI in the period of 2003-2016 caused the reduction of corruption (increase the value of the CPI) by 0.67 % in EU member countries.

It is necessary mention that the positive effect of E-government was not proved in all EU countries. This finding just supports the well-known fact that there are many possible roots of corruption. The corruption occurs in various areas of public administration and takes numerous forms. For this reason, e-Government is not a panacea for fighting corruption, which would be effective in all countries. It is also not possible to generalize the results of this paper for other periods and other groups of countries. The findings from the analysis, however, confirm the conclusions of numerous studies and consider the e-Government as a tool for reducing corrupt behaviour of officials in the public sector also in EU countries.

Acknowledgements

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