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Can E-Government Serve as a Tool for Public Authorities to Manage Public Resources More Efficiently?

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ABSTRACT

Innovations in the field of telecommunications and technological development in information processing affect the provision of public services. One of the main priorities of governments is to achieve greater efficiency in the provision of public services and e-government is one of several measures implemented. Our study aims to determine how e-government and efficiency affects the provision of public services in general, and also by functions. We apply a different model to calculate efficiency of the provision of public services and by function. Our empirical analysis, which included correlation and multiple linear regressions, was applied in 2012-2014 for a single cross-section of 35 economies. The results show a significant relationship between e-government and efficiency. Furthermore, we obtain a significant relation between Online Services, Telecommunication Infrastructure and Human Capital with efficiency in the provision of public services.

KEYWORDS

E-Government, Human Capital, International Benchmarking, Online Services, Public Expenditure Efficiency, Telecommunication Infrastructure

1. INTRODUCTION

The economic and financial crisis of the last few years has profoundly affected the organization and management of public administrations. The decline in financial resources, along with other problems such as excessive bureaucracy, overregulation, corruption, dishonesty in public contracts and the lack of these, plus the demands of the citizens for quality public services, have led to several countries' implementing a new model of organization and control of their public administrations: "Network-Administration" Welp et al. (2007), using new technologies, such as the Internet. This model seeks to renew and update the previous management model, mainly through accounting, which was incorporated by public administrations of several OCEDE countries in the 1980s: "The New Public Management" (NPM), as well as the model applied by the Clinton Administration - National Performance Review

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(1993) - based on performance and the satisfaction of the needs of citizens, who are considered as their customers Gore (1993).

The implementation of new information technologies ICT and the development of e-government in the public administration management helps reduce costs, and makes proceedings more flexible and links the different administrations with the aim of increasing the efficiency and quality of public services, in addition to improving the relationship between the public authorities, the private sector and citizens (Dunleavy and Margetts, 2000; Prins, 2001; Fountain, 2001; Hinnant and Moon, 2001; Chadwick and May, 2003; Borras, 2004; Chiang and Liao, 2009; Verdegem and Verleye, 2009).

According to a study carried out by Chadwick and May (2003), most countries have focused their efforts on developing the application e-government in the area of the management and on the simplification of administrative procedures, the so-called "Managerial Model", since its implementation is simple, it adapts to the existing organization in public administrations (Fountain, 2005; Dreschler, 2005; Olsen, 2006) and results are quickly observed, leaving other important aspects pending, such as the opinion of the citizens, the "Consultative Model" and the active participation of citizens in the management of public services "Participatory Model" (Dunleavy and Margetts, 2000; Fountain, 2001; Chadwick & May, 2003).

Many studies seek to determine the impact of the implementation of e-government in the public administrations and have focused on whether the application of this system increases the efficiency in the management of public services. Several authors (La Porte et al., 2002; Demchak, 2000; Dunleavy et al., 2003; Chaddwick and May, 2003; Thompson and Garbacz, 2007; Sung, 2007; Chiang and Liao, 2009; Ala-Mutka et al., 2009; Huijboom et al., 2009) have determined that it increases productivity through standardization and digitization in the development of public activities, which reduce costs and improve the delivery of public services and, therefore, should increase their efficiency. Other authors have attempted to determine how the new technology is managed and used by citizens, especially consultants, in their relations with public administrations, Accenture (2004), Urgell et al. (2005), Fountain (2005), and Aibar et al. (2006). However, yet other authors, such as Welp et al. (2007), have tried to determine the affects the application of new technologies of information has for both the management of the public administrations and the relations with citizens in the provision of public services.

The objective of our study is to analyze the influence in the efficiency in the provision of public services of certain variables when applying e-government in the management of public administration like Online Services (OLS), Telecommunication Infrastructure (TI), and Human Capital (HC).

In addition, we analyze how the GDP pc control variable, influences the efficiency of public services, since more developed Governments should have "being more efficient" among their priorities, and they can apply and maintain the technology needed to implement e-government.

The remainder of this paper is organized as follows. First, the methodology is presented and we present the estimation models. We then offer an explanation of the sample, data and variables. The data analysis results are then given and interpreted. Finally, we draw the conclusions.

2. METHODOLOGY

In order to test the association between the impact of the principal variables composing e-Government and Public Expenditure Efficiency, both for the general government and for its functions, the statistical analysis included correlation and multiple linear regressions.

Linear regressions analysed the relative impact of the most important dimensions of e-Government [namely: scope and quality of Online Services (OSI), development status of Telecommunication Infrastructure (TI), and inherent Human Capital (HC)] on Public Expenditure Efficiency, both for the general government and for its functions. Finally, state of development [Gross Domestic Product per capita (GDP pc)] and the impact of information and communication technology on access to basic services (ITCaccess) have were included as control variables.

Hypothesis 1: e-government (EDGI) has a positive impact on the development on Public Expenditure Efficiency (PEEI):

$$PEEI_{it} = \beta_0 + \beta_1 EDGI_{it} + \beta_2 ITCaccess_{it} + \beta_3 GDPpc + \varepsilon_{it} \quad (1)$$

where PEEI is the public expenditure efficiency index in year t; EDGI is the e-government index in year t; ITCacess is the impact of information and communication technology on access to basic services in year t; GDPpc is the natural logarithms of gross domestic product per capita in year t.

Hypothesis 2: Online Services (OSI), Telecommunication Infrastructure (TI) and Human Capital (HC) have a positive impact on the development on Public Expenditure Efficiency (PEEI):

$$PEEI_{it} = \beta_0 + \beta_1 OSI_{it} + \beta_2 IT_{it} + \beta_3 HC_{it} + \beta_4 ITCaccess_{it} + \beta_5 GDPpc_{it} + \varepsilon_{it} \quad (2)$$

where PEEI is the public expenditure efficiency index; OSI is the scope and quality of Online Services; TI as the development status of Telecommunication Infrastructure; HC as the inherent Human Capital; ITCacess is the impact of information and communication technology on access to basic services; GDPpc is the natural logarithms of gross domestic product per capita.

3. SAMPLE AND VARIABLES

The sample employed in this study consists of 35 economies - the 28 European Union Member States, 2 EU candidate countries (Iceland and Turkey) and other key advanced economies - the United States, Japan, Switzerland, Norway and the Republic of Korea; for the period 2012-2014. These economies accounted in 2014 for nearly fifty per cent of the World's GDP pp, demonstrating that the findings are globally important. The final sample is a complete panel data of 105 country-year observations.

The variables used were, Public Expenditure Efficiency Index (PEEI): an estimate with the aggregation of the more than 60 most representative socioeconomic indicators (xfij)-considered as proxies for the services provided - in macroeconomic environment, public institutions, economic performance, infrastructures, innovation, markets, environmental protection, health, education and social protection, grouped in six weighted clusters in line with the COFOG classification (2014).

We designed output-input indicators to measure public efficiency in the different functions of the government (PEEIf) and, mathematically, PEEI for the general government is a weighted average of the different normalized scores of the public efficiency by function:

- **Public Expenditure Efficiency Score for Country:** See below:

$$PEEI_j = \sum PEEI^*_{fj} w_{fj} \; w_{fj} = \frac{E_{fj}}{TGE_j}$$

- **Public Expenditure Efficiency in the different functions of the government ($PEEI_f$):** We estimated Country's Public Sector Performance, in function f and country j, as well as overall Country's Public Sector Performance, in country j:

$$PEEI_{fj} = \frac{PSP_{fj}}{E_{fj} / GDP_j}$$

An empirical application of the proposed model was carried out using information from the Executive Opinion Survey (EOS), World Economic Forum, [WEF (2013-2014]. Other independent sources were used, such as The World Bank; International Labor Organization (ILO); and United Nations Educational, Scientific and Cultural Organization (UNESCO) for the years 2012-2014:

- **E-Government variable (EDGI):** Variable is calculated by the sum of the three variables that compose the e-government: online services index (OSI), Telecommunication Infrastructure (TI) and Human capital (HC);
- **Online Services Index (OSI):** Index values, e-Government Survey 2012-2014 (United Nation, 2012- 2014) assessed each country's national website, including the national central portal, e-services portal and e-participation portal, as well as the websites of the relevant Ministries of Education, Labor, Social Services, Health, Finance, and Environment. The assessment questionnaire consisted of four sections, corresponding to the four stages of e-Government development (Emerging information services; Enhanced information services; Transactional services; and Connected services);
- **Telecommunication Infrastructure (TI):** Index values, e-Government Survey 2012-2014 (United Nation, 2012-2014) is an arithmetic average composite of five indicators: internet users; telephone lines; mobile subscription; fixed internet subscriptions; and fixed broadband;
- **Human capital (HC):** Index values, e-Government Survey 2012-2014 (United Nation, 2012-2014) is a weighted average composite of two indicators: adult literacy rate and the combined primary, secondary, and tertiary gross enrolment ratio, with two-thirds weightings assigned to adult literacy rate and one-third weight assigned to the gross enrolment ratio;
- **Impact of Information and Communication Technology (ITCaccess):** Impact of Information and Communication Technology on access to basic services. Data are collected on a regular basis through the Executive Opinion Survey (WEF, 2013- 2014);
- **Gross Domestic Product per capita (GDPpc):** Gross domestic product per capita in current US dollars. Data are collected in World Bank national accounts data 2012-2014.

Table 1 shows the main descriptive statistics of the variables. The mean value of Public Expenditure Efficiency Index moves around 2.71 and the e-government variable (EDGI) shows a mean value of 0.75.

Table 2 shows the Pearson correlation coefficients and statistical significances between the variables. The correlation coefficients of OSI and TI with PEEI are significantly positive.

A higher level of Online Services (OSI) and Telecommunication Infrastructure (TI) were associated with a significantly higher level of Public Expenditure Efficiency.

4. RESULTS OF EMPIRICAL ANALYSIS

The results of Model 1 and 2 are presented in Table 3 and 4, respectively. We use t-statistics based on standard errors clustered at the country and the year level (Petersen, 2009), which are robust both to heteroskedasticity and within-firm serial correlation. The results of the Model 1 show a consistently significant positive relationship between e-Government (EDGI) and Public Expenditure Efficiency (PEEI). These results provide strong evidence for the effect of e-Government on increasing Public Expenditure Efficiency. Our findings provide support for Hypothesis 1.

PEEI is the public expenditure efficiency index in year t; EDGI is the e-government index in year t; ITCacess is the impact of information and communication technology on access to basic services in year t; GDPpc is the natural logarithms of gross domestic product per capita in year t. Regressions are run using two-way cluster standard errors (Petersen, 2009) at the time and country level which are robust to both heteroskedasticity and within-firm serial correlation.

Table 1. Descriptive statistics

	Mean	Median	Std. Dev.	Min	Max
PEEI	**2.71**	**2.39**	**0.61**	**1.72**	**3.95**
EDGI	0.75	0.77	0.11	0.52	0.93
OSI	0.58	0.67	0.16	0.46	1
TI	0.47	0.54	0.14	0.35	0.83
HC	0.71	0.89	0.04	0.37	0.95
ITCaccess	4.86	5.06	0.68	3.8	6.01
GDPpc	9.73	9.69	0.88	7.88	11.03

Table 2. Pearson correlation coefficients and statistical significances

	PEEI	OSI	TI	HC	ITCaccess	GDPpc
PEEI	1					
OSI	0.38*	1				
TI	0.54**	0.64**	1			
HC	0.19	0.49**	0.42*	1		
ITCaccess	0.62**	0.63**	0.71**	0.15	1	
GDPpc	0.57**	0.53**	0.79**	0.39	0.67**	1

**, * denote significance at the 1% and 5% level, respectively.
Note: The sign of the correlation coefficient (i.e., positive or negative) defines the direction of the relationship.

Table 3. Regressions of PEEI on e-government and control variables

Model 1: $PEEI_{it} = \beta_0 + \beta_1 EDGI_{it} + \beta_2 ITCaccess_{it} + \beta_3 GDPpc + \varepsilon_{it}$		
Variables	**Estimated Coefficient**	**t-Statistic**
Intercept	-1.175	-1.50-
EDGI	0.175	2.86***
ITCaccess	0.155	1.64*
GDPpc	0.297	2.23**
N	105	
R^2 (adjusted)	0.540	
F	17.34***	

*, **, *** Significantly different from zero at the 0.10, 0.05 and 0.01 levels, respectively, (two-tailed)

PEEI is the public expenditure efficiency index in year t; OSI is the scope and quality of Online Services in year t; TI as the development status of Telecommunication Infrastructure in year t; HC as the inherent Human Capital in year t; ITCacess is the impact of information and communication technology on access to basic services in year t; GDPpc is the natural logarithms of gross domestic product per capita in year t. Regressions are run using two-way cluster standard errors (Petersen, 2009) at the time and country level which are robust to both heteroskedasticity and within-firm serial correlation.

Table 4. Regressions of PEEI on e-government variables and control variables

Model 2: $PEEI_{it} = \beta_0 + \beta_1 OSI_{it} + \beta_2 TI_{it} + \beta_3 HC_{it} + \beta_4 ITCaccess_{it} + \beta_5 GDPpc_{it} + \varepsilon_{it}$		
Variables	**Estimated Coefficient**	**t-Statistic**
Intercept	-0.537	-0.72-
OSI	0.169	3.55***
TI	0.159	3.54***
HC	0.120	3.62***
ITCaccess	0.254	3.04***
GDPpc	0.053	0.56
N	105	
R^2 (adjusted)	0.761	
F	16.16***	

*, **, *** Significantly different from zero at the 0.10, 0.05 and 0.01 levels, respectively, (two-tailed)

The results of Model 2 show a consistently significant positive relationship between Online Services Index (OSI) and Public Expenditure Efficiency (PEEI). E-Government (OSI) affords citizens faster and easier access to all basic services of public institutions, which increases the degree of efficiency in the provision of such services. The use of (OSI) standardizes services and simplifies their management, so facilitating and streamlining decision-making in the public administrations [Jakobs (2000), Fang (2002) and Schachter (2007)]. This process favors the reduction of costs in the provision of public services, due to the decrease in staff and simplification of processes, Yeh et al. (2005), so increasing the availability of resources for the provision of services. This result coincides with those obtained by Higgins and Hallström (2007), Galera et al. (2008) and Chiang and Liao (2009).

The positive effect of Online Services (OSI) on public efficiency differs across functions. On the other hand, no consistent association was observed between Online Services (OSI) and Public Expenditure Efficiency in Health, or in Education. This situation is due to the nature of the services; some allow the application of technological systems standardized, reducing management costs and facilitating the access of the population [Jakobs (2005), Isaak (2006), Sung (2007) and Thompson and Garbacz (2007)], and some do not, due to their particular characteristics. In the latter case, it is necessary to apply individualized processes adapted to each situation that arise. This involves the application of a significant volume of resources that ensure the development of the appropriate technology for the services provision. These results agree with those obtained by Jakobs (2005) and Wang and Kim (2007).

Model 2 shows a consistently significant positive relationship between Telecommunications Infrastructure (TI) and Public Expenditure Efficiency (PEEI). The higher the level of Telecommunications Infrastructure (TI), the more effective the e-government is, and this will have a greater impact on the efficiency of public services. Zhao (2013) and Al-Khanjari et al. (2014) establishes a positive and significant relationship between the variable Telecommunication Infrastructure (TI) and the variable efficiency in the provision of public services. These results agree with those of Jakobs (2005), Higgins and Hallström (2007) and Galera et al. (2008).

The studies by Dwyer et al. (2005), Srite and Karahanna (2006) and Zhang and Maruping (2008) determined that a suitable cultural level of the population is essential for a proper use of e-government. Zhao (2013) determines that Human Capital (HC) influences the variable e-government significantly

and positively. Therefore, we consider it appropriate to include the effect of the HC variable to determine the behavior in relation to the efficiency of public services.

The results show how the variable has a positive and significant relationship with the level of efficiency in the provision of public services. These results agree with those of Mathieson (2007) and Purao and Souza (2011).

The results of Model 2 provide support for Hypothesis 2.

Figure 1 shows the relationship between e-government and Public Sector Performance more clearly.

The positive effect of e-government (EDGI) on public efficiency, both for the general government and for most of the public functions, is greater in countries with higher GDP pc or state of development.

The application of e-government to the management of public services requires large investment in technology and training of both staff and citizens. Such a volume of investment can only be made by countries with a high level of economic development. These results agree with those obtained by Torkzadeh et al. (1999), Khan (2002) and Deng et al. (2004).

As Figure 2 shows, empirical results also reveal that the EU is far from being a homogeneous entity in terms of public efficiency and e-government (EDGI) development. On the contrary, large disparities exist among Member States, with some countries performing better than both the EU average and other advanced economies, such as the United States, while others perform far worse. Many countries with low levels of e-government (EDGI) remain at lower levels of public efficiency, while many countries with high levels of e-government (EDGI) remain at higher levels of public efficiency. This situation coincides with the results obtained, since those countries with a lower GDP pc have not completed the necessary technological reform in their public administrations and the population does not have the necessary resources to be able to relate to the administration through

Figure 1. Relationship between e-government and public sector performance

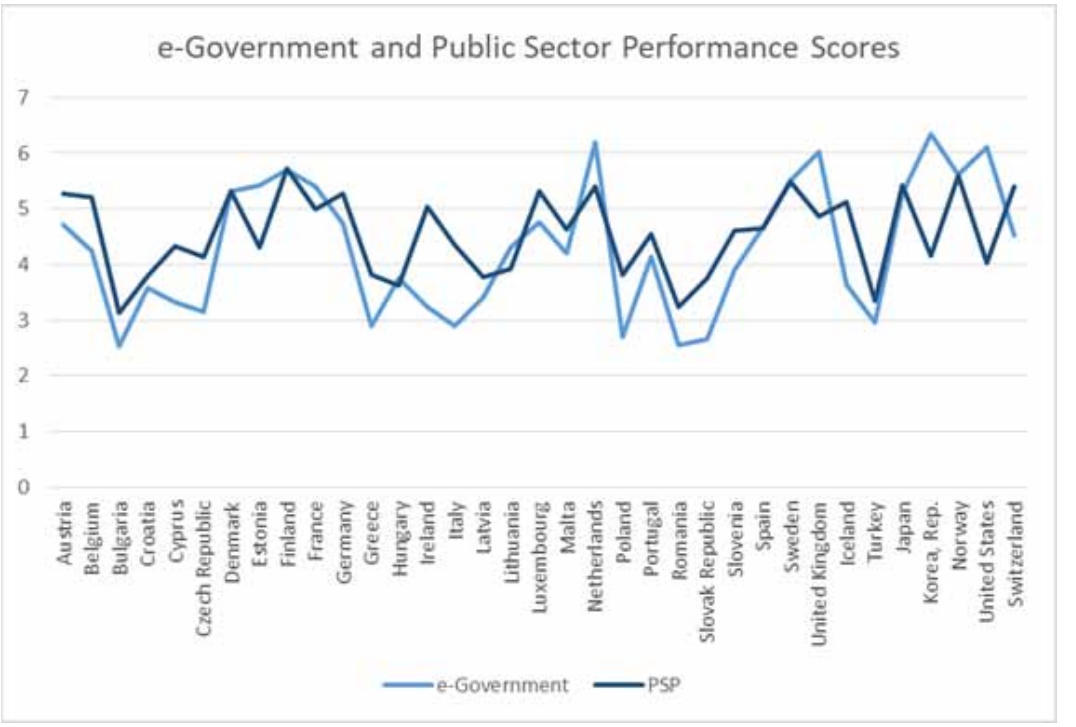
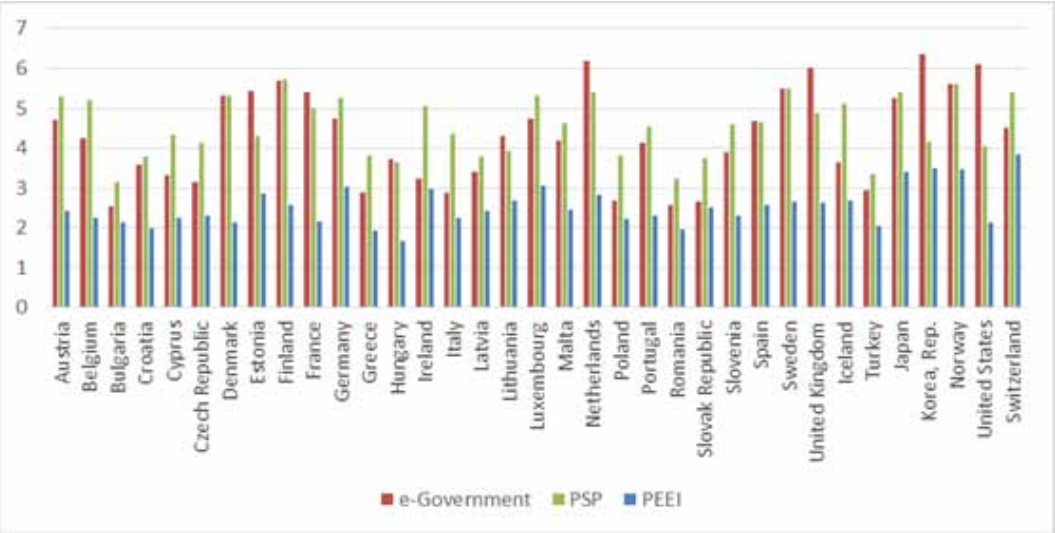


Figure 2. Empirical results



e-government [Van Deursen et al. (2006), Bertot amd Jaeger (2008) and Van Dijk et al. (2008)]. Therefore, the lack of resources and investment is one of the major problems that these countries have in getting e-government (EDGI) to improve quality and efficiency in the provision of public services.

Efficiency and e-government (EDGI) results across European and benchmarking countries are summarized in Table 5 below, where the economies are also ranked on a global basis. A high ranking indicates that countries with a strong e-government (EDGI, have a strong efficient position, and countries with low e-government (EDGI) have a low efficient position. The results coincide with those of Thompson and Garbacz (2007), which determine that those countries with greater technological investment and Internet development are more efficient in the provision of public services. More developed countries (with a higher GDP pc) are achieving greater technological development and greater efficiency in the provision of public services.

Table 5 highlights significant differences across countries. Countries with the highest overall PEEI score are Switzerland, the Republic of Korea, Norway and Japan. Among EU countries, only Luxembourg is in the top 5. Even economies with a high level of efficiency can be more efficient if they know and work on their weaknesses. The analysis shows that Japan and the Republic of Korea should focus on Environmental Protection; the United States on General Public Service, Order and Safety, as well as on Health and Education; and Switzerland on Education. Finland is the most efficient in Environmental Protection, Luxemburg in Health, and the United Kingdom in Economic Affairs. If we did not take into account private expenditure on health, the United States would notably improve its rank.

The comparison of the different sub-indicators across countries may provide further and more specific insights and lessons.

On the e-government side, the Republic of Korea, the United States and the United Kingdom are the leaders in Online Service, Switzerland and Iceland in Telecommunication Infrastructure (TI), and Ireland and the Republic of Korea in Human Capital (HC).

In relation to the state of development, if we classify the economies by GDP pc according to the Global Competitiveness Index rules (see WEF, 2013, p. 9 et sq.), economies in state 2 and transition offer low levels of e-Government, as well as in public efficiency. Estonia, Latvia and Lithuania are outliers that might be worth studying.

Table 5. e-government and efficiency scores, 2014

Country	EDGI		OSI		TI	HC	PEEI		peei_ GPSOS		peei_EA		peei_EP		peei_H		peei_E		peei_SP	
		Ranking		Ranking				Ranking		Ranking		Ranking		Ranking		Ranking		Ranking		Ranking
Austria	0.78	**15**	0.75	**14**	0.70	0.91	2.42	**18**	3.48	**15**	2.43	**23**	4.62	**8**	3.40	**25**	2.63	**17**	1.54	**26**
Belgium	0.77	**18**	0.65	**21**	0.74	0.93	2.25	**24**	2.66	**27**	1.73	**30**	3.84	**13**	3.28	**26**	2.82	**14**	1.68	**20**
Bulgaria	0.61	**33**	0.49	**34**	0.50	0.85	2.12	**29**	3.79	**12**	1.91	**28**	1.84	**25**	1.00	**35**	5.14	**4**	1.62	**22**
Croatia	0.73	**21**	0.64	**22**	0.70	0.86	1.99	**32**	2.20	**30**	1.72	**31**	5.57	**4**	2.49	**27**	1.71	**28**	1.85	**16**
Cyprus	0.65	**29**	0.56	**27**	0.52	0.88	2.25	**25**	1.53	**34**	4.39	**8**	1.00	**35**	4.92	**3**	1.28	**31**	2.28	**5**
Czech Republic	0.65	**30**	0.54	**28**	0.52	0.89	2.32	**21**	3.31	**17**	1.86	**29**	1.50	**31**	3.48	**22**	1.91	**24**	2.14	**11**
Denmark	0.89	**4**	0.86	**8**	0.86	0.95	2.12	**28**	2.85	**25**	5.00	**4**	6.36	**2**	3.47	**24**	1.14	**34**	1.31	**32**
Estonia	0.80	**14**	0.82	**11**	0.66	0.91	2.87	**8**	5.32	**4**	3.16	**19**	2.48	**17**	4.62	**9**	1.74	**27**	2.22	**8**
Finland	0.85	**9**	0.88	**5**	0.72	0.95	2.57	**14**	3.75	**13**	3.69	**15**	7.00	**1**	3.61	**20**	3.47	**12**	1.42	**28**
France	0.86	**6**	0.88	**6**	0.79	0.92	2.15	**27**	3.35	**16**	4.47	**7**	1.16	**34**	3.63	**19**	2.09	**21**	1.18	**33**
Germany	0.81	**11**	0.75	**13**	0.78	0.90	3.04	**6**	3.99	**9**	5.42	**2**	4.37	**9**	3.80	**17**	4.91	**5**	1.67	**21**
Greece	0.69	**27**	0.58	**25**	0.55	0.93	1.93	**34**	1.00	**35**	3.17	**18**	5.04	**7**	3.98	**13**	5.76	**3**	1.00	**35**
Hungary	0.72	**22**	0.69	**17**	0.57	0.91	1.68	**35**	1.90	**32**	1.45	**33**	1.76	**26**	2.48	**28**	2.29	**20**	1.32	**31**
Ireland	0.71	**25**	0.54	**30**	0.66	0.95	2.96	**7**	3.52	**14**	4.57	**6**	2.31	**21**	3.67	**18**	3.98	**9**	1.87	**15**
Italy	0.72	**23**	0.58	**25**	0.67	0.91	2.25	**23**	1.75	**33**	3.58	**17**	2.27	**22**	4.51	**11**	4.26	**7**	1.12	**34**
Latvia	0.66	**28**	0.59	**24**	0.51	0.89	2.41	**19**	4.09	**8**	2.23	**27**	2.44	**19**	2.05	**32**	2.45	**19**	2.26	**6**
Lithuania	0.73	**20**	0.70	**15**	0.58	0.92	2.69	**10**	3.97	**10**	3.92	**14**	4.13	**11**	2.48	**29**	2.66	**16**	2.14	**12**
Luxembourg	0.80	**13**	0.70	**15**	0.86	0.84	3.07	**5**	5.51	**3**	4.23	**10**	1.75	**27**	7.00	**1**	1.23	**33**	1.81	**18**

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Table 5. Continued

Country	EDGI		OSI		TI	HC	PEEI		peei_ GPSOS		peei_EA		peei_EP		peei_H		peei_E		peei_SP	
		Ranking		Ranking				Ranking		Ranking		Ranking		Ranking		Ranking		Ranking		Ranking
Malta	0.71	**26**	0.61	**23**	0.72	0.81	2.44	**17**	3.12	**20**	2.35	**25**	1.56	**30**	3.56	**21**	1.47	**30**	2.19	**9**
Netherlands	0.91	**2**	0.96	**4**	0.83	0.94	2.83	**9**	4.17	**7**	3.05	**20**	1.58	**28**	3.48	**23**	4.11	**8**	2.03	**14**
Poland	0.64	**31**	0.54	**30**	0.49	0.90	2.21	**26**	3.14	**19**	2.40	**24**	2.47	**18**	4.08	**12**	1.97	**23**	1.34	**30**
Portugal	0.72	**24**	0.65	**20**	0.60	0.89	2.32	**20**	2.01	**31**	4.64	**5**	4.26	**10**	3.80	**15**	2.81	**15**	1.40	**29**
Romania	0.61	**34**	0.52	**32**	0.42	0.88	1.97	**33**	3.05	**22**	1.17	**34**	1.58	**29**	2.35	**31**	3.61	**10**	1.58	**24**
Slovak Republic	0.63	**32**	0.50	**33**	0.51	0.87	2.51	**16**	2.39	**29**	3.60	**16**	2.09	**23**	2.39	**30**	4.42	**6**	2.24	**7**
Slovenia	0.75	**19**	0.67	**19**	0.65	0.93	2.30	**22**	3.11	**21**	2.96	**21**	3.04	**16**	3.95	**14**	1.78	**26**	1.48	**27**
Spain	0.78	**17**	0.76	**12**	0.63	0.94	2.56	**15**	2.68	**26**	1.00	**35**	3.68	**14**	4.56	**10**	5.81	**2**	1.61	**23**
Sweden	0.86	**7**	0.84	**10**	0.82	0.91	2.66	**12**	3.85	**11**	4.17	**11**	5.56	**5**	4.66	**8**	1.55	**29**	1.56	**25**
United Kingdom	0.90	**3**	0.97	**3**	0.81	0.90	2.63	**13**	3.30	**18**	7.00	**1**	2.36	**20**	3.80	**16**	2.08	**22**	1.71	**19**
Iceland	0.78	**16**	0.54	**28**	0.88	0.93	2.69	**11**	2.45	**28**	2.96	**22**	3.09	**15**	4.73	**7**	1.00	**35**	3.00	**3**
Turkey	0.53	**35**	0.46	**35**	0.35	0.77	2.04	**31**	2.91	**24**	2.33	**26**	1.43	**33**	1.07	**34**	2.52	**18**	2.17	**10**
Japan	0.80	**12**	0.86	**7**	0.65	0.90	3.41	**4**	4.53	**5**	4.02	**13**	2.09	**24**	4.87	**4**	7.00	**1**	1.82	**17**
Korea, Rep.	0.93	**1**	1.00	**1**	0.84	0.95	3.50	**2**	4.44	**6**	1.52	**32**	1.48	**32**	4.85	**5**	2.86	**13**	7.00	**1**
Norway	0.86	**8**	0.86	**8**	0.79	0.93	3.48	**3**	7.00	**1**	4.29	**9**	4.01	**12**	4.75	**6**	3.60	**11**	2.10	**13**
United States	0.87	**5**	1.00	**1**	0.69	0.92	2.12	**30**	2.93	**23**	5.23	**3**	5.50	**6**	1.20	**33**	1.26	**32**	3.53	**2**
Switzerland	0.81	**10**	0.67	**18**	0.88	0.89	3.84	**1**	6.97	**2**	4.14	**12**	6.01	**3**	6.41	**2**	1.87	**25**	2.63	**4**

Note: Each sub-indicator contributes to PEEI with different weights (WFJ), which emulates the effect of different government preferences.

5. CONCLUSION

Public administrations have devoted a large part of the resources available to the implementation of the e-government (EDGI), to achieve a more efficient management of all their activities and in the provision of public services. In this work we analyze how they affect the variables Online Services (OSI), Telecommunication Infrastructure (TI) and Human Capital (HC) efficiency in the provision of public services in general, and classify these services by functions, following the Classification of the Functions of Government (COFOG). We use a sample of 35 countries, representing almost 50% percent of the world GDP.

The results show the existence of a significant relationship between the impact of Online Services (OSI) on access to basic services and public efficiency. Online Services (OSI) simplifies management of public services and reduces production costs, therefore having a positive impact on the efficiency of the public services.

However, if we analyze this variable with the efficiency of public services by functions, we note that in the Health and Education functions there is no significant relationship, since these services list some features related to the provision of services that prevent a more effective application of the Online Services (OSI).

To enhance our analysis we incorporated the variable Online Services (OSI), Telecommunication infrastructure (TI), and Human Capital (HC). The results show a significant and positive relationship with the efficiency in the provision of services in general and functions. We take into account factors that may influence a better implementation of e-government (EDGI) and that can significantly affect the efficiency of public services, including Health, despite its special characteristics.

Furthermore, the positive effect is higher in countries with more GDP pc or state of development. Therefore, only countries with greater resources can implement these systems of communication and management properly and effectively. These results agree with Higgins and Halström (2007), Galera et al. (2008) and Chiang and Liao (2009).

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