

**THE IMPACT OF E-GOVERNMENT STRATEGY ON
ECONOMIC GROWTH AND SOCIAL DEVELOPMENT**

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Dissertation submitted as partial requirement for the degree of Master in
Economics

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October 2017

Abstract

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The digital revolution significantly re-organizes the daily lifestyle of people and habitual ways and means of doing business. The public sector cannot disregard the new trends of postindustrial information economy. If public administrations are to remain responsive, accountable and efficient in the XXI century, they need to transform the way they function by making more and better use of information and communication technology. Implementation of e-government aims to support modernization of the public sector enabling its openness, transparency and effectiveness. The evidence from existing literature shows that besides the reduction of administrative burdens, improvement of information and service quality and cost reduction, e-government is able to streamline economic and social development of the nations. However, due to the lack of arguments that prove the importance of e-government adoption at the same level as resolution of other economic and social problems that occur on the national levels, some critical opinions were expressed against the need of investment in the digital government.

This research applying correlation and regression analysis using the panel data of 34 European countries during the period of 2003 until 2014, aims to evaluate the impact of e-government strategy on economic and social development and its ability to enhance wealth creation and to improve exciting social policies. Results provide an evidence of the positive significant effect of e-government implementation on GDP growth and several social indices, such as Rule of law, Political stability and Health index with significant decrease of Mortality rate at the same time.

Key words: e-Governemnt, Development

JEL - Codes: H11, O1

Resumo

O impacto da estratégia do Governo Eletrónico no crescimento económico e desenvolvimento social

Por Daria Gustova

A revolução digital reorganizou significativamente, tanto o estilo de vida diário das pessoas, como as formas habituais e meios de fazer negócios. O setor público não pode ignorar as novas tendências da economia da informação pós-industrial. Se as administrações públicas são para continuar a ser responsivas, responsáveis e eficientes no século XXI, precisam de transformar a forma como funcionam, fazendo mais e melhor uso da tecnologia da informação e da comunicação. A implementação de governo eletrónico tem como objetivo apoiar a modernização do setor público, possibilitando a sua abertura, transparência e eficácia. A evidência da literatura existente mostra que, além das reduções dos encargos administrativos, melhoria da informação, qualidade de serviço e redução de custos, governo eletrónico é capaz de agilizar o desenvolvimento económico e social das nações. No entanto, devido à falta de argumentos que demonstrem a importância da adoção do governo eletrónico ao mesmo nível que a resolução de outros problemas socioeconómicos que ocorrem aos níveis nacionais, algumas opiniões críticas foram expressas contra a necessidade de investimento no governo digital.

Esta pesquisa, que aplicou uma análise de correlação e regressão, usando dados de um painel de 34 países europeus durante o período de 2003 a 2014, tem como objetivo avaliar o impacto da estratégia de implementação do governo eletrónico no desenvolvimento económico e social e a sua capacidade de potenciar a criação de riqueza e de melhorar políticas sociais estimulantes. Os resultados mostram sinais do efeito positivo e significativo da implementação do governo eletrónico sobre o crescimento do PIB e em diversos indicadores sociais, tais como, no Estado de Direito, na estabilidade política e em índice de saúde com uma diminuição significativa da taxa de mortalidade ao mesmo tempo.

Palavras-chave: Governo eletrónico, Desenvolvimento

JEL - Códigos: H11, O1

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1. Introduction

Development of information and communication technology is one of the most important indicators characterizing an innovation and information economy, availability of electronic services affects the national competitiveness, creates a safe environment for investment and business opportunities, accelerates productivity and growth. Modern information technologies form a new economy, which is based on a knowledge, rather than on the increasing consumption of irreplaceable natural resources. This new economy is based on intellectual resources, information and communication technologies, science-intensive industries, modern services that create a qualitatively new technological level of the entire national economy.

In the innovation and information economy the state becomes the main initiator of the development of high-tech industries and telecommunication infrastructure. None of the states, without prejudice to itself and its citizens, can ignore the most important tendencies in the formation of the new society of the XXI century that assumes the inevitable transformation of political institutions and public administration through introduction of Internet technology in the public sector activities. One of the key innovation change in the public administration that will help the government to be compliant with the latest information and technological changes is the implementation of electronic government (e-government).

From the period of introduction of the World Wide Web until today, the topic about e-government strategy brings the discussion regarding the effectiveness of the implementation of digital government and the role of new technologies in the development processes. During the recent growth of the concept of e-government, different critical opinions were expressed regarding the investment in information technology when at the same time some countries face serious economic problems and challenges to provide quality social services to the citizens. From another side, researchers believe that e-government is the necessary tool that can provide the opportunity to narrow social and economic inequalities and enhance wealth creation on the national levels.

This research following the optimistic point of view, aims to evaluate the impact of implementation of e-government on economic and social development and to provide policy recommendations for better introduction and adaptation of new strategy in the public sector. In

order to achieve this target this study presents four main steps. Firstly, it analyses the existing literature base, focusing on understanding the concept of e-government and its historical development and verifies the main effects of digital government. Secondly, this study puts forward two hypothesis of the impact of e-government and presents the conceptual modelling for the further empirical analysis. Thirdly, after collecting the data of 34 European countries during the period from 2003 to 2014, it performs the correlation and regressions analysis, reports achieved results, tests the model for its robustness and analyses further effects digital government. Finally, based on achieved results, this research presents three main areas for policy recommendations for the advancement of the effects of e-government strategy.

Therefore, this study is structured in 4 main sections. Section 2 presents a brief literature review of the topic. Section 3 proposes the hypothesis of the study and applied methodology. Section 4 presents the main empirical analysis and findings. Section 5 concludes achieved results and provides policy recommendations on implementation of e-government.

2. E-Government: Brief Review of the Literature

2.1. Definition of e-government and its components

Transition to post-industrial society involves the transformation of the political institutions and governments to meet new requirements of the information era. New information integrative technologies are becoming more widespread; they became the basis of globalization and have a significant effect on social development. Within the past decade, the topic of e-government expansion, implementation and adoption has acquired a deep interest from government institutions, hence the question arises – what is the literature research base that may support the analysis of e-government effectiveness and evaluation of true merits of e-government initiatives.

Considering the aim of the research as an identification of the main impacts of e-government implementation on economic growth and social development at the country level and determination of policy recommendations for optimal strategic model for its formation, it is necessary to understand the concept of e-government and thoroughly define its main components.

The term "e-government" has become a part of the modern lexicon and is being considered as a key instrument of modernizing government in the XXI century. Optimists believe that the introduction of e-government in activities of state and municipal authorities will ensure a bright future; on the other hand, some skeptics assume the possibility of strengthening corruption. However, a unified approach to the disclosure the content of e-government has not been formed yet. Many scholars have criticized prevailing poor research practice with the lack of methodological and theoretical framework in e-government study. Yildiz reviewing the literature in e-government field concludes that existing findings “do not tell us what is happening inside the black box of e-government” (Yildiz, 2007: 660). Moreover, there is a lack of comprehensive and accepted definition of e-government. E-government is being considered by governance as a technology that should improve the work of existing institutions and re-organize the system of interaction between governments and their constituents, between governments and citizens, businesses and employees. It brings “new rules of the game”, the rules of this interaction. Many existing papers define e-government as simply an Internet tool

to deliver services to citizens and businesses, however the implementation of e-government systems goes further to the fundamental transformation of production processes in public sector.

The World Bank (2015) has published one of the most widespread definition of e-government that states “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. These technologies can serve a variety of different ends: better delivery of government services to citizens, improved interactions with business and industry, citizen empowerment through access to information, or more efficient government management”. Similarly, Riley, defining e-government as “a central theme in information society at all levels such as local, national, regional and global as well”, assumes that “e-government has, or can transform public sector internal and external relationships through the use of information and communications technology to promote greater accountability of the government, increase efficiency and cost effectiveness, and create greater constituency participation” (Riley, 2007: 1). As it can be seen from the definitions above, main target groups of e-government initiatives are governments and their constituents, citizens, businesses and employees. By parity of reasoning, e-government delivery models include four blocks as it shown on the Figure 1.

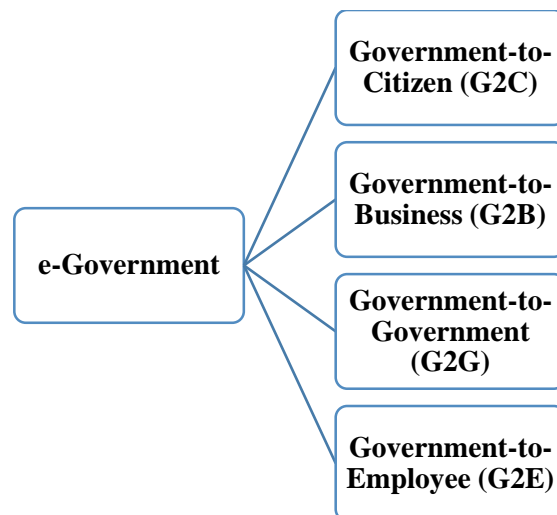


Figure 1. Types of e-government application.

Firstly, Government-to-Citizens provides real rights of citizens to freely search, receive, transmit, produce and disseminate information relating to such important issues as budgetary

process and state property management increasing transparency of public authorities and local governments.

The second direction, Government-to-Business, focuses on interactions between government and private sector in the field of taxation, customs clearance documentation, registration and liquidation of legal entities, issuing licenses and certificates, and the preparation and submission of reporting documentation. Introduction of information technologies in this type of interactions is capable to improve supply chain management and increase the country business competitiveness.

Thirdly, Government-to-Government involves an improvement in efficiency of public authorities and local governments due to application of inter-departmental electronic information management systems and development of new administrative workflows that, in turn, leads to cost reduction, better coordination of public entities and the creation of a fundamentally new capacity for monitoring processes from an economic and social point of view.

Finally, Government-to-Employee improves the development of the labor market, the level of satisfaction of employees, and support transactions such as payroll and pension plans, which overall indirect impact improves the labour productivity at the national level. This proposed information technology intends to replace passive forms of political communication and contribute to a more informed and active citizen.

Some of the components of e-government have already been implemented on a small scale in different countries; however, the full picture of e-government development and its main benefits has not been fully analysed yet. The absence of appropriate research base of e-government and, accordingly, non-realization of e-government potential support the statement of Ndou (2004: 3) that “one of the reasons why many e-government initiatives fail is related to the narrow definition and poor understanding of the e-government concept, processes and functions”. The development of the e-government research area is being criticized by its under-theorized level (Scholl, 2006; Flak, Sein, and Sæbø, 2007), therefore, making the studying of the effectiveness of e-government implementation more challenging.

2.2. Development of e-government research

The history of e-government development keeps step together with the formation of informational innovations. Existing literature defines two main groups of e-government research: prescriptive and descriptive. Basing on this division, we analyze the main characteristics and contributions of each group.

Prescriptive literature

The beginning of the study of information technologies and their impact on the social development of society can be considered as the 90s of the 20th century. In that period, due to introduction of the World Wide Web, it has been developed all the necessary material and ideological conditions for widespread use of information and computer technology in the relations between the state institutions with citizens and businesses. At the same time, it became evident that the use of modern technology makes it possible not only to automate existing governance processes, but it also enables qualitative transformation of public service delivery including the reduction of administrative costs for the government organizations. The literature published during the initial stage of e-government development was primarily focused on the evaluation of the impact of new technologies. Richard Heeks (1999) in his book has already mentioned the benefits gained by the government in the new information age, such as increased efficiency, decentralization, increased accountability, improved resource management and marketization. Other authors have also an optimistic point of view about the introduction of information technology in government processes and strongly believe in the new information era with a new open and direct democracy. However, authors like Hague and Loader notice that ICTs should not be considered as a panacea of all the illnesses of existing democracy, but as a new tool to achieve radically different goals such as a “strong democracy” (Hague and Loader, 1999).

Taking into account that an optimistic view about the new age information technologies in government activities has prevailed, however, there can be found some authors that did not share the same beliefs (Mickunas and Pilotta, 1998). From this side, ICTs were considered as a source of violation of privacy and could play a “Big Brother” role.

The contribution of prescriptive literature is difficult to assess due to its marketing nature and promotion of new e-democracy without any critical review of its concept and implementation. From another side, publications that were made during the initial stage of the development of ICTs in government activities attracted the attention of governance institutions, research centers and individual scholars to analyze the impact of the introduction of Internet technologies into the government transactions and its social benefits.

Descriptive literature

Starting from the late 1990s, the process of implementation of e-government applications started to grow rapidly and e-government started to become a reality in many countries. Therefore, the main objective of published literature was a provision of practical recommendations of successful adoption of information technologies into the government. The evolution of the theory, including extension of definitions, identification of variables or formulation of hypotheses, was not the priority of the research made during that period, on the contrary, the target was to collect and analyze the best practices of the use of Internet technologies in the current governance. The analysis of best practices can be found in works of Whitson and Davis (2001), Millard (2002), Jaeger and Thompson (2003) and others. For instance, the paper of Whitson and Davis (2001), “Best practices in electronic government: comprehensive electronic information dissemination for science and technology”, presents a successful case study of implementation of a digital environment applied to scientific and technical information transactions of the United States Department of Energy, such as collecting, organizing, archiving, disseminating and using information in research and development activities. Authors provide an analysis of the implementation concept of e-government application for the entire business element, its future directions and benefits gained by this transition into the electronic information environment.

In the middle of 2000s, the way of analysing e-government has changed contributing with deeper examination of the causes of e-government phenomena, its functionality, critical variables and interactions between them. The research in this area started to have a qualitative nature, overcoming the theoretical weakness that was observed in the early stages of e-government evolution.

A significant contribution to the development of existing research in digital government field was made by the publication of Grant and Chau (2006) “Developing a generic framework for e-government. *Advanced Topics in Information Management*”. In this paper authors, collecting available visions and concepts on the idea of introduction of information technologies into the government procedures, contribute with a generic framework for online government that allows policy makers to identify e-government strategic agenda. The paper provides a mapping of different components of electronic government into the general system and a comparison of differences and similarities across its implementations.

Luna-Reyes and Gil-García (2011) that proposed a new method of understanding the phenomena of electronic government made one of the steps for development of a methodological base of e-government research area. The paper shows that combination of institutional theory with computer simulation, in this case synthesis of technology enactment framework and system dynamics, provides a comprehensive approach in understanding the relationships between information technologies, organizational factors, institutional arrangements and socio-economic environment.

Another work that contributed to extend the methodological framework and is worthy of note within the current study is a paper by Lucio Picci (2006), “The quantitative evaluation of the economic impact of e-government: A structural modelling approach”. Picci proposes a structural model for analysing economic consequences of e-government in a multi-level governance environment and applies this model to an Italian region, Tuscany, to the year 2000. Considering the final outcome of the model as regional private output, the results show that aggregated e-government (regional and central policies) introduction does not have a direct effect on the relevant variable. However, it has three main influences: firstly, aggregate e-government initiatives produce savings in the provision of services to citizens and the business sector; secondly, it increases the level of employment in the private sector; thirdly, due to improvement of technology, it affects the production processes.

Descriptive literature in the field of e-government adoption has started a new wave of analysis, classifying demand and supply sides of the new technological era, including end-users and providers from corresponding perspectives. Demand-side literature was mainly focused on the acceptance of new Internet applications by users while interacting with government institutions, as well as analysis of user-friendliness of introduced systems, modifications of previously

established ways to communicate with public entities, requests for further developments, etc. The idea of supply-side literature was focused on examination of providers of e-government technologies, including generation of local and international datasets.

Summarizing the contribution of descriptive literature, it can be seen that the development of theory or methodology in e-government research area did not make a lot of progress due to its focus on the practical side of implementation of electronic systems for government performance. From another side, this kind of studies plays an important role in the further development of e-government research bringing important assets, such as provision of successful case studies and practical recommendations for adoption of digital government, classification of the fields of analysis into the supply and demand side, extension and increasing availability of datasets and much more. The best practices and benchmarking studies of e-government transformation are being continuously used by public administrations while promoting and implementing e-government systems.

2.3. Impact of e-government adoption

Four main guidelines for the economic policies of the Member States of the European Union of the current 2020 Europe strategy are promotion of investment, enhancement of growth through Member States' implementation of structural reforms, removal of key barriers to social growth and jobs at Union level and improvement of the sustainability and growth-friendliness of public finances. One of the pillars to perform these guidelines is the Digital Agenda that was presented by European Commission, which proposes to better exploit the potential of information and communication technology (hereinafter – ICT) in order to foster innovation, economic growth and progress. According to the Digital Agenda, e-government is one of the key areas of the Information Society policy in Europe where further progress is required to reach the objectives of digital transformation of government.

Existing literature provides a thorough analysis of the impact of effective e-government implementation and can be grouped in the following interconnected benefits:

2.3.1. Improvement of information quality and information supply

Public sector is being considered as one of largest producers of information, therefore the question about the quality of provided information arises. Digitalization of information through

the online services has a positive impact on the level of information quality and supply in the public sector. Information provided in electronic format decreases the amount of errors and consequently provides the basis for building quality management information systems (Chevallerau, 2005).

The study by Wangpipatwong, Chutimaskul and Papasratorn (2005) provides a clear evidence that the quality of delivered information by public entities through the e-government systems is a significant factor that influence better adoption of digital government. Authors show that all explored characteristics of information quality, such as accuracy, timeliness, relevance, precision, and completeness, significantly affect the level of acceptance of e-government websites by citizens. Considering the management implications of these results, in order to achieve better development of information technologies in the public sector and its benefits, high quality online delivering of public services needs to be ensured.

Introduction of ICT in government activities supports improvement of information supply and, particularly, the openness of the data. Availability and openness of government data provides greater returns of public investment, stimulation of economic growth and wealth due to free flow of information for businesses, stimulation of innovation, increase in transparency and accountability.

2.3.2. Reduction of process time

Implementation of e-government strategy has a significant effect on the reduction of the time expenditure for process and delivery of services, both for public administrators and citizens. The adoption of web-based technologies in public sector activities can be considered as a catalyst in delivery of government services. Active use of e-government websites allows minimization of the process time and encouragement of users to use the online service. Beneficial results of the digital government are also gained by the streamlining of internal processes due to faster decision making and by increasing the speed and quality of transaction processing (Ndou, 2004).

Basing on the example of e-government project in China named Beijing's Business E-Park, it has been shown that the processing time of administrative tasks has been reduced dramatically. The process of approval for specific applications has eliminated long and bureaucratic workflow and has accelerated from 2-3 months to a few days (Lin et al., 2001). In Singapore,

transition from 20 paper forms for trade license application to one online form has reduced the processing time from 15 days to 15 seconds (Al-Kibsi et al., 2001).

2.3.3. Reduction of administrative burdens

Reduction of administrative burden implies lowering of private costs by citizens and businesses that they bear to comply with information and registrations defined by the governmental organizations. Rowley (2011), developing a stakeholder benefits analysis tool, considers reduction of administrative burden as one of the main benefits achieved by small-to-medium sized enterprises, public administrators (employees) and government agencies participating in e-government. According to Eurobarometer survey (2013), the introduction of ICT has a significant role for businesses due to reduction in the amount of time it takes to complete government forms and to receive a response from the public administrations. The study published by Godel, Harms, Jones and Mantovani for European Parliament (2016) states that administrative burdens can be distinguished by necessary costs (time and effort spent by businesses on compliance) and unnecessary burdens (the non-functional payments), and, therefore, technologies in government are focused on minimizing the costs that are strictly necessary.

A more neutral point of view on the impact of e-government on reduction of administrative burdens was expressed in the paper “Does e-government reduce the administrative burden of businesses? An assessment of business-to-government systems usage in the Netherlands” (Arendsen et al., 2014). The results of the survey made by the authors showed neither positive, nor negative impact of digitalization of government in lowering burdens. The explanations of such result may come from the fact that larger businesses do not experience administrative burden at the same level as small and medium enterprises.

However, more skeptical opinion about benefits gained due to adoption of information technology can be seen in work of Malone, Yates and Benjamin (1987), where they state that government institutions being the dominant provider of electronic hierarchy are the ones who receive more benefits than the other stakeholders while reducing governmental costs during the digitalization process.

2.3.4. Cost reduction

One of the most discussed economic impacts of adoption of e-government are cost reduction and budget savings that lead to realization of one guidelines of 2020 Europe strategy, improving the sustainability and growth-friendliness of public finances. Achievement of these results can be explained by paperless environment of administrative procedures and consequently, minimization of transactional costs of government processes and better control of public expenditures (Bhatnagar, 2003).

Cost reduction and budget savings achieved by governance due to the use of information technologies in administrative activities can be explained as following:

1. Savings in labor costs: the application of ICT in public service delivery lowers its labor costs due to reduction of administrative employees that are required to perform the maintenance of e-government processing. Moreover, automation process reduces the time needed for a certain type of work leading to the raise of the labor productivity and consequently, to achievement of analogous targets with less number of employees.
2. Savings in service delivery: minimization of leading time of service realization (reduction of travel costs, waiting time, printing materials, etc.).
3. Savings in electronic invoicing: adoption of e-invoicing leads to greater automation and removes unnecessary handling of papers between different public authorities or through the post offices. For example, government of United Kingdom every year sends in average 100 million invoices with a total value of £192 billion paying by each invoice process £40, therefore, spending two percent of government revenues on administrative processing. Using the electronic invoice systems can reduce the processing cost to £4 per invoice (Graham, 2015).

Although cost reduction on the grounds of digitalization of government is one of the major areas of potential impacts, the empirical part of such a transition to electronic environment does not always lead to the decrease in costs. Considering the developing countries where internet penetration is still on the low level, the e-government implementation does not become a substitution of traditional interactional tool with public sector, but on the contrary, it turns into an additional channel of service delivery. The level of acceptance of new technologies by citizens in emerging countries on the average is smaller than in the developed countries. Therefore, initially costs increase due to the investment made in the information technologies.

For this reason, the scientific community is developing different evaluation methodologies in order to assess the opportunity of e-government adoption in developing countries. The paper by Kertesz (2003) proposes a strategy of analysing three main types of costs during the e-government introduction, such as pre-implementation costs (internal investments for infrastructure and work-process redesign), implementation costs (costs of building the electronic portal for government) and operational costs (administration and maintenance costs). Combining initial and supporting costs with expected benefits and risks, the author applies the Net Present Value (NPV) methodology in order to evaluate the success of considered e-government project and avoid the loss-making results. Therefore, one of the recommendations for policy makers in order to achieve more efficiency in digital government projects is the essential preliminary evaluation of the costs, benefits and risks of ICT investment.

2.3.5. Improvement of service quality and user satisfaction

With introduction of ICT into the government processes, the quality of public services becomes a topic of great discussion. Adoption of e-government systems enables citizens and businesses to have an “any time anywhere” access to variety of public services with more detailed and complete information, opportunity to make a thorough monitoring and analysis of available services and customize its delivery.

According to EU eGovernment Report 2016, the general trend in developing digital government in Europe have progressed over time increasing the accessibility of online public services up to 81% across EU Member States. However, the analysis of user satisfaction, especially in terms of ease and speed of use, shows a poor progress in comparison to the analysis made in 2013. Governments started to focus less on the quality of delivery, therefore, shifting the central point of quality improvement from citizens-oriented to the business-oriented side. The report shows that while the availability of digital services in 2016 has increased by 9 percent in comparison to 2013 and online usability has raised by 4 percentage points, the quality factors, such as the ease of using and speed of using has improved just by one percent (European Commission, 2016). Achievement of these results caused a determination of priorities for new EU eGovernment Action Plan that includes realization of a high-quality public service delivery with a focus on user centricity during the digital interactions between citizens, businesses and public administrations.

Research on e-government service quality has developed different methodologies allowing evaluation of public service level through the digital channels. One of the works presented by Papadomichelaki and Mentzas (2009) basing on the assessment model of physical service market SERVQUAL (Parasuraman et al., 1988) develops a multiple-item scale for measuring e-government service quality considering four quality dimensions, such as reliability, efficiency, trust and citizens support (interoperability). It provides an evidence that these factors are the main attributes that improve the level of e-government services; therefore, they may be used in order to perform a better implementation of digital government or in order to evaluate modifications of existing e-government portals and corresponding services.

Another significant contribution for evaluation of e-government service was developed in the paper “COBRA framework to evaluate e-government services: A citizen-centric perspective” (Osman et al., 2014). Proposed model differs from the existing literature due to its focus on the user-perspective of e-government service delivery analyzing the most critical factors of digital administration and associated variables of its user satisfaction. Designed model considers four dimensions of success in public service delivery through the digital channels, such as cost, opportunity, benefit and risk. On the practical assessment of e-government portal in Turkey it was shown that these four constructs are able to explain 76% of user satisfaction and obtain a comprehensive evaluation of the quality of electronic services.

Additionally, stepping up the involvement of businesses, citizens and administrators into the improvement of e-government services has a significant role in efficient implementation of digital government due to the fact that the improvement of the connections between citizen and public entities for high-quality public services increases the trust in public administration. The study by Belanche Gracia and Casaló Arino (2015) developing a structural equation model provides an evidence that perceived governmental e-service quality has a positive impact on trust in the public administration. Obtained results may be explained by signaling theory (Schlosser et al., 2006), which stays that individuals make inferences according to the signals they receive from governmental actions, such as an investment in e-service quality and continuously improvement of existing technologies. Therefore, citizens and businesses identify the effort made by public administration in order to deliver a high quality services and build trust in digital interaction with public entities.

Besides the above-mentioned quantitative impacts of government digitalization, the existing research provides wider qualitative effects that arise mostly through the indirect channels (Chevallerau, 2005):

1. Improvement in accountability and transparency due to the free accessibility and openness of government data, which in turn, provides necessary information for citizens and businesses increasing trust in public administration and stimulating development of new business opportunities.
2. Promotion of information society advances the level of participation in technological progress by citizens and private sector, which reflects in growth of e-participation index and user acceptance of digital modernization.
3. Reduction in corruption is achieved through an ability of society to analyze public data and information and through the elimination of barriers in interactions with governmental organizations.
4. Increase in national competitiveness arising from improvement in productivity and efficiency of public sector and consequently, catalyzing the economic growth and social development.

As it can be seen from the analysis above, the literature in e-government service quality provides an evidence of the importance of support and maintenance of a high quality e-government channels. Therefore, public authorities should perform the principle of user centricity during the software development and implementation.

2.4. Impact of e-government on economic growth and social development

Research on economic and social aspects of e-government policy implementation is focused on determination of factors and challenges influencing efficient adoption of digital government and on evaluation of impacts of ICT penetration in both private and public sector. The most studied economic and social development indicators that are used to measure the impact of e-government on the national level are the following: GDP per capita, economic competitiveness and economic performance, government efficiency, use of ICT in the private sector, innovation index and education (Stanimirovic et al., 2013). The existing studies also provide evidence that the effect of e-government implementation on economic performance of the nation differs for

developing and developed countries. One of the contributions supporting this theory was made by Srivastava and Panigrahi (2016). Basing on Partial Least Square (PLS) technique, authors shows that the relation between e-government development and economic performance in developing countries has a significant positive effect, however in developed countries it does not have any impact.

Per capita gross domestic product is considered as one of the most crucial indicator for analyzing the effectiveness of transition to the digital government. Corsi et al. (2006), in a study commissioned by the European Commission for the e-government unit, states that given the fact that a large share of European countries GDP's belongs to the public sector, the efficiency of public administration may be considered as one of the drivers for national competitiveness, economic growth and welfare. E-government implementation being the tool of an increase in public sector efficiency enhances GDP growth through four main channels: improved labour productivity in the public sector, growth of public sector total output, efficiency of public administration and increase in aggregate demand.

Firstly, introduction of wider forms of e-government programs positively influence on the increase in the labour productivity in the public sector. Proposed productivity function for the public sector includes four different effects of digital government on labour productivity: Smith's effect, Ricardo's effect, Back-office effect, Schumpeter's effect and the Take-up effect:

- Market enlargement or Smith's effect states that adoption of e-government programs increases the supply capacity of the public sector assuming that users demand all produced services.
- The substitution or Ricardo's effect assumes that in case of decrease in the cost for innovation in comparison to the labour cost it is more profitable to partially substitute the latter with wider implementation of e-government technologies.
- Back-office re-organization effect shows that public sector will perform a re-organization when costs of service delivery are higher than its perceived value.
- Investments in innovation or Schumpeter's effect states that investment in ICT in public sector due to the adoption of e-government policy after a time lag will lead to the improvement of public sector productivity and, therefore, stimulate the long-run economic growth.

- Take-up effect explains the acceptance of digital government by society due to the upward trend in public service delivery through the web channels, increase in the service quality and, therefore, raise in its demand. The assumption that follows a take-up effects states that technology boost in public sector leads to a greater openness for new electronic services by citizens and businesses and, as a results, increases the productivity of public services.

Secondly, wider usage of information technologies in public sector stimulate the enlargement of services provided by public sector due to simplification of processes and increased efficiency, and at the same time providing a higher degree of transparency and accountability in public administration. Authors assume that these factors play an accelerating role in welfare formation, which, consequently, reflects in the national accounts.

Thirdly, diffusion of better technological and organizational standards leads to improvements in public administration efficiency, and, consequently, to the public sector as a whole. Efficient administration positively influence the fostering of innovation and becomes a driver of modernization.

Finally, by forming new relationships in interactions between public administrations and private sectors, reallocating information and creating new business opportunities, e-government policy affects the growth in aggregate demand and triggers the economic growth.

Corsi et al. (2006) built a model for assessing the economic impact of e-government introduction and estimated the results by means of regression analysis in two forms – in growth rates and in absolute values. Using empirical data at EU level, they find an evidence of a strong impact of e-government expenditures on the improvement in public sector productivity and GDP growth. It has been shown that e-government policy will contribute to overall increase in GDP at EU-level in the period of 2005-2010 by 2%. Considering this result, the authors provide important policy recommendations in order to achieve better performance of digital government relating to economic growth, including improvement in the efficiency of public administrations, development of specific tools for evaluating adopted projects and acceptance of policies focused on streaming up the take-off effect.

However, the impact of e-government in the GDP leads to the question of whether a positive effect after the introduction of information technologies in government operations will be the same for all countries, taking into account their different levels of development. From this point

of view, e-government programs have a significant chance to fail in the developing countries. The main benefit such as reduction in costs that is more essential in countries with a high level of development may become a bitter truth for developing countries with poor and immature IT infrastructure. Developing countries often do not have required level of telecommunications and Internet accessibility, which leads to an increase in costs for e-government adoption, and in some cases nullifying the difference between predicted benefits and expenditures made for this implementation. In case of developing countries, the implementation plan of digital government has to be thoroughly analyzed according to the national economic and technological environment in order to avoid creation of design-reality gaps following an example of high-industrialized countries (Heeks, 2003).

Moving to the next widely discussed impact of ICT in public sector, the idea of positive relationships between e-government development and national competitiveness was thoroughly analyzed in different perceptions. Srivastava et al. (2008), estimating a model from a cross-country perspective, provides an evidence of significant contribution of e-government maturity as well as e-participation level on business competitiveness across chosen countries. Estimated results show that greater level of e-government development influence a higher level of national business competitiveness. Analyzing achieved outcome further, authors find out that the moderating role of these relationships belongs to human capital and public institutions, therefore, the importance of investment in building of literate human capital and efficient public administration should be noticed during the application of digital policies.

Supporting the idea of increased business competitiveness environment due to the adoption of information technologies to the public sector, e-government research provides analytical and empirical evidence of the positive impact of digital government on the economic activity of firms. These results are supported by the cost reduction based on lower transactional costs, transparent and innovative business environment and savings achieved through quicker e-custom channels (Vu et al., 2006).

Equally important contribution of e-government adoption is an increased government efficiency that includes two main channels of measurement. Firstly, re-organization and re-engineering of administrative processes by implementing web technologies leads to reduction of resources that are needed for providing services for businesses and citizens. Secondly, transforming 'the balance of power' between different levels of public management, e-

government has a significant effect on improvement of administrative processes efficiency (Chochliouros et al., 2008).

Considering two interrelated impacts of digital government, such as streamlining the use of ICT in the private sector and increase in innovation index, the research does not provide a strong methodological base. However, most of the authors acknowledge the positive influence of e-government systems on promotion of information economy based on demonstrative effect of public administrations and therefore, increasing the level of modernization and innovation both in the public and in the private sector (Lau, 2005).

Finally, introduction of e-government improves an equal accessibility to education and jobs through better social policies, management and service quality. The Global Information Technology Report 2016 within the framework of the World Economic Forum states that development of digital economy affects potential employment creation of 2.7 million jobs worldwide (Baller et al., 2016). Well-educated and qualified nation contributes to the increase in productivity of the economy and therefore, stimulates faster economic growth.

3. Methodology

3.1. Objectives of the research and hypothesis formulation

The key objectives of this research are developed according to the theoretical foundation presented by the recent scientific literature, which implies that the availability of e-government digital services along with greater access to information and contribution of citizens and businesses in e-government adoption leads to the strengthening of trust in public authorities and positively influence the economic performance and social development of the nations. In this context, the relationship between e-government and economic growth and social development becomes a relevant issue that should be analyzed.

This research has three key objectives: first, basing on empirical datasets, verify possible relationship between e-government and economic growth and social development; second, determine the direct benefits of e-government implementation; third, basing on the empirical model results, provide policy recommendations for the development of e-government strategy.

Hypotheses formulation

Economic growth

A study of the diffusions of information technologies into the public sector found that development of e-government policies has a positive influence on economic performance of the countries, therefore it positively affects the growth of GDP (Corsi et al., 2006). Thus, it is predicted that:

H1: E-government development will positively influence on the GDP growth among European countries.

Social development

E-government aims to support the implementation of the European Digital Agenda and the 2030 Agenda with defined sustainable development goals promoting transparency, accountability, efficiency and citizen engagement in public service delivery (United Nations E-Government survey 2016). This research focuses on the social development of the nations, including the level of the rule of law, political stability and public health. Thus, it is predicted that:

H2: E-government development will positively influence on the social development among European countries.

3.2. Methodology

3.2.1. Data of the model

Target countries

The database of the research consists of 34 European countries without including dependent territories or areas of special sovereignty. This research mainly deals with countries that are current members of the European Union, however, some non-European Union countries, such as Albania, Belarus, Iceland, Norway, Russian Federation and Ukraine were also included in the sample. In many parts of this research, nine countries were not included due to the lack of available data.

The choice of this research to focus on the analysis of e-Government implementation in European countries is based on the active promotion of the Digital Single Market by the European eGovernment Action Plan 2011-2015 and the European eGovernment Action Plan 2016-2020 that aim to modernize the public administration both at the national and supranational level.

Time specifications

The time period of the analysis is fully based on the availability of the data published by the United Nations in the Global e-government development reports and surveys during the period of 2003 until 2014. Due to the different frequency of e-government assessments performed by the United Nations, the time observations have the following structure: from 2003 until 2005 with one-year interval, and from 2008 until 2014 with two-year interval.

3.2.2. Conceptual modeling

The study investigates how the level of e-government development affects the economic growth and social development of the nations in European countries. The evaluation of digital government adoption in this research is supported by the conceptual modelling of e-government impact proposed in the paper for the United Nations General Assembly second committee “E-Government for Promoting Sustainable Development in Small Island Developing States” (Lee, 2014). For the purpose of more thorough research of the influence of the digital government on different areas of national development in Europe, this study is based on the modeling of two

separated approaches: the impact of e-government strategy on economic growth and its impact on national social development (see Figure 2).

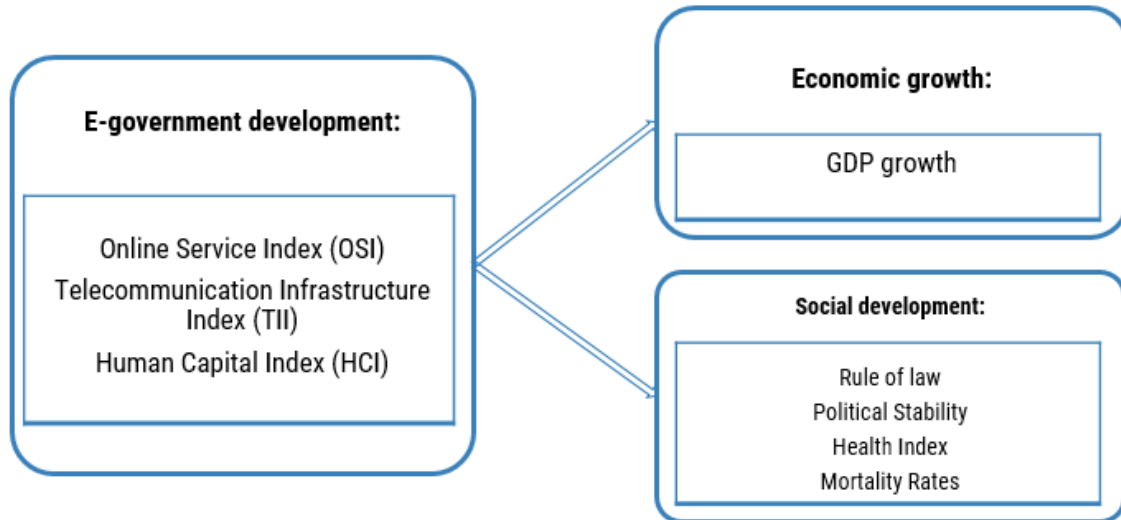


Figure 2. Conceptual modeling: the impact of e-government development on economic growth and its impact on national social sustainability.

3.2.3. Measurement

Measurement on e-government development

The level of e-government development in this research is adopted from indices of the United Nations Surveys during the period of 2003 until 2014. According to the United Nations, the level of e-government development composes from three main indicators:

1. Online Service Index (OSI)
2. Telecommunication Infrastructure Index (TII)
3. Human Capital Index (HCI)

These three indicators are the most important dimensions in the assessment of the application of e-government policies among the nations and their weighted average of normalized scores constitutes an index of absolute measurement – E-government development index (EGDI):

$$EGDI = \frac{1}{3} (OSI_{normalized} + TII_{normalized} + HCI_{normalized}) \quad (1)$$

Prior normalization of the EGDI components using the Z-score standardization procedure was implemented to all of the indicators in order to ensure that each of the EGDI components presents comparable variance subsequent to the Z-score standardization:

$$x_{new} = \frac{(x-\mu)}{\sigma}, \quad (2)$$

where:

x is a raw score that needs to be standardized,

μ is the mean of the population,

σ is the standard deviation of the population.

The composite value of all three standardized EGDI indicators is then normalized to fall in the range between 0 and 1.

The first component of e-government development is the Online Service Index (OSI), which represents the variety of the online services available for the citizens and businesses through the national governmental portals and websites in the field of finance, social services, health, education and others. In order to build the Online Service Index, a total of 111 researchers from 60 countries evaluated national portals based on criteria defined by the Unit Nations. For the total number of points scored by each of the country the normalization and Z-score standardization procedures were implemented.

The second component of EGDI is the Telecommunication Infrastructure Index (TII), which in turn includes the following measurement: (i) amount of individuals using the Internet, (ii) amount of main fixed telephone lines, (iii) amount of mobile-cellular subscriptions, (iv) amount of wireless broadband subscriptions, (v) amount of fixed (wired) broadband subscriptions. The measurement indicators of TII are Z-score standardized and normalized.

The third component of e-government development is the Human Capital Index (HCI) that evaluates the ability of inhabitants to use implemented e-government services. Human Capital Index is characterized by the adult literacy, gross enrolment ratio at the primary, secondary and tertiary levels, expected years of schooling and the average number of years of schooling. Similar to calculating TII, the measurement indicators of HCI are Z-score standardized and normalized.

Additionally to the EGDI and its components, the analysis includes the E-Participation index (EPI) in order to evaluate the usage of online services by citizens and businesses for accessing the information and interaction with public entities. E-Participation index describes the provisions of information online (e-information), interaction of citizens and businesses with public entities (e-consultation) and active participation of inhabitants in decisions making (e-decision-making). Table 1 summarizes the measures on e-government development used in this research.

Area	Factor	Variables/Indicators	Sources
ICT Infrastructure	Telecommunication Infrastructure Index (TII)	Individuals using the Internet (% population)	UN E-Government Surveys 2003-2014 (based on International Telecommunication Union data)
		Fixed-telephone subscriptions (per 100)	
		Mobile-cellular subscriptions (per 100)	
		Wireless broadband subscriptions (per 100), replaced fixed Internet subscriptions in 2014	
		Fixed (wired)-broadband subscriptions (per 100), replaced online population since 2008	
Ability to use e-government	Human Capital Index (HCI)	Number of television sets, removed in 2008	UN E-Government Surveys 2003-2014 (based on UNDP Human Development Reports)
		Adult literacy (%)	
		Gross enrolment ratio at the primary, secondary and tertiary levels (%)	
		Expected years of schooling	
E-public service	Online Service Index (OSI)	Average number of years of schooling	UN E-Government Surveys 2003-2014
		Variety of the online services available for the citizens and businesses through the national governmental portals and websites	
E-Democracy	E-Participation Index (EPI)	E-information, e-consultation, e-decision-making	UN E-Government Surveys 2003-2014

Table 1. Measurement on e-government development.

Measurement on economic growth and social development

The level of economic development in this research is measured by the real Gross domestic product growth rates of chosen sample of European countries. The growth rate of GDP is sourced from International Monetary Fund database based on World Economic Outlook published in April 2017. The real economic growth rate is expressed as a percentage change of country's GDP during the specified time period, such as one year.

Considering the social development, this study is focusing on the social and political stability, not limited to the level of rule of law, health indexes and mortality rates. This research aggregates several indicators in order to analyze the social development of the nations. The chosen measures of social development include the following indicators:

1. Rule of law reflects the public confidence in the police force and judicial system, in the rules of society, particularly, security of property rights, enforceability of private contracts and government contracts, trust in police and independence of the judiciary, likelihood of crime and violence. The indicator of the level of rule of law is sourced from the World Bank's Worldwide Governance indicators.
2. Political stability characterizes the probability of a disorderly transfer of government power, violent and armed conflicts, as well as international tensions and terrorism. Similarly to the index of the rule of law, political stability indicator is drawn from the World Bank's Worldwide Governance indicators.
3. Mortality rate in this research will be limited to the analysis of under-five mortality rate that informs us about the rates of deaths of children from the birth date until the age of five years expressed per 1000 live births. The indicator of under-five mortality rate is sourced from Human Development Index reports under United Nations Development Program (UNDP).
4. Health index represents a live expectancy of newborn children. The measurement of the health index is expressed in the expected number of years. The sources of this indicator are UNDP Human Development Index reports.

This information is summarized in Table 2.

Area	Factor	Variables/Indicators	Sources
Economic growth	Real Gross domestic product growth rates	Real GDP growth rate (annual percent change)	International Monetary Fund database (based on World Economic Outlook published in April 2017)
Social development	Rule of law	The extent of public confidence in the police force, judicial system and social rules	World Bank's Worldwide Governance indicators
		Security of property rights, enforceability of private contracts and government contracts	
		Likelihood of crime or violence	
	Political stability	Unlikelihood of a disorderly transfer of government power, violent and armed conflicts, as well as international tensions and terrorism	World Bank's Worldwide Governance indicators
	Mortality rate	Under-five mortality rate per 1000 live births	UNDP Human Development Index reports
Health index	Live expectancy of newborn children	UNDP Human Development Index reports	

Table 2. Measurement on economic growth and social development.

Measurement on control variables

This research controls for the following: voice and accountability, size of the population, the level of inflation and the total government expenditure. The control variables are presented in the Table 3:

Area	Factor	Variables/Indicators	Sources
Democracy	Voice & Accountability	Ability of citizens to participate in the selection of government; right to freedom of expression, independency of media, freedom of association	World Bank's Worldwide Governance indicators
Social Condition	Population (log)	Logarithmised size of the population	World Bank Data
Economic Condition	Inflation	Annual percentage change of the average consumer prices	International Monetary Fund database (based on World Economic Outlook published in April 2017)
Size of the Government	Total government expenditure	Total expense and the net purchase of nonfinancial assets	International Monetary Fund database (based on World Economic Outlook published in April 2017)

Table 3. Measurement on control variables.

Firstly, the indicator Voice & Accountability characterizes the ability of citizens to participate in the elections of government, their confidence in honesty of such elections, ability to express freely and freedom of the media and of access to information. It is important to note that this study did not include the indicator of Voice & Accountability as a good governance component due to the focus of this indicator not on internal features of good governance but on relationships between citizens and their government.

Secondly, both the size of the population and inflation can affect economic and social development of the nation, therefore the logarithmised value of the population and the inflation rate were included in the model.

Finally, Total government expenditure measures the total expense of the public sector and net purchase of nonfinancial assets. Barro (1991) and Oni et al., (2014) analysing the effects of government sector on the competitiveness of the nations argued that the level of government expenditure influences the economic growth and national development. The values of government expenditure have significant differences between EU Member States regarding both the size and the function of government expenditure, therefore, this study moderates the impact of total government expenditure including it as an additional control variable.

3.2.4. Model specifications

In order to analyze the impact of e-government implementation for the chosen set of European countries during the period from 2003 until 2014 this research uses panel data models and the Stata software.

In general, the panel data regression model has the following form:

$$Y_{it} = \beta_1 + \beta_2 x_{it2} + \dots + \beta_k x_{itk} + u_{it}, \quad i = 1, \dots, n; t = 1, \dots, T, \quad (3)$$

Where Y_{it} is the dependent variable, x_{itk} are explanatory variables with k indicating the number of them and u_{it} represents an error term.

The above equation may also be rewritten as:

$$Y_{it} = x'_{it}\beta + u_{it} \quad (4)$$

Working with panel data we assume $n > T$, meaning that we suppose a large number of entities (cross-sections) and a small number of time periods.

The usage of the panel data model provides numerous advantages in the estimation of parameters due to its combination of the time-series and spatial observations analysis (Hsiao, 2007):

1. Panel data allows consideration of the individual unobserved heterogeneity.

2. Panel data model provides less collinearity among explanatory variables.
3. The usage of panel data provides an opportunity to study the dynamics of changes in individual characteristics of units of the population.
4. Allowing design and testing of more complex behavioral models, panel data are more advantageous in identification and measurement of effects that are not detectable only in time series or only in spatial data.

Assumptions

The properties of the estimators in a linear panel data model can be established according to the following assumptions (Greene, 2000):

- *PL1: Linearity*

$$Y_{it} = \beta_1 + \beta_2 x_{it2} + \dots + \beta_k x_{itk} + u_{it} \quad (5)$$

- *PL2: Rank condition*

Identification of $\beta \begin{pmatrix} x_{11}x'_{11} \\ \dots \\ x_{1T}x'_{1T} \end{pmatrix}_{T \times k}$ is of rank k .

- *PL3: Exogeneity of the independent variables.* No correlation between the independent variables and the error term:

$$E(x_{1t}u_{1t}) = 0_{k \times 1}, t = 1, \dots, T \quad (6)$$

- *PL4: Homoskedasticity and nonautocorrelation*

Homoskedasticity and nonautocorrelation assumption implies that the variance of the errors is the same across observations. This condition is given by:

$$E(u_{1t}u_{1s} | x_{1t}x_{1s}) = \sigma_{ts}, t, s = 1, \dots, T \quad (7)$$

Thus,

$$\Omega_{T \times T} = E(U_1 U_1' | X_1) = \begin{pmatrix} E(u_{11}^2 | x_{11}) & \dots & E(u_{11}u_{1T} | x_{11}, x_{1T}) \\ \vdots & \ddots & \vdots \\ E(u_{1T}u_{11} | x_{1T}, x_{11}) & \dots & E(u_{1T}^2 | x_{1T}) \end{pmatrix} = \begin{bmatrix} \sigma_1^2 & \dots & \sigma_{1T} \\ \vdots & \ddots & \vdots \\ \sigma_{T1} & \dots & \sigma_T^2 \end{bmatrix} \quad (8)$$

- *PL5: Independent observations*

3.2.5. Diagnostic and robustness tests for analysis of the model

In panel data models, the error term u_{it} is often decomposed as follows:

$$u_{it} = \alpha_i + \varepsilon_{it}, \quad (9)$$

where α_i is an individual effect and ε_{it} is an error term. The individual effects model can be rewritten as:

$$Y_{it} = x'_{it}\beta + (\alpha_i + \varepsilon_{it}) \quad (10)$$

In the model, we can have α_i as a random effect (RE) or as a fixed effect (FE).

Decision between fixed or random effects is made by running the Hausman test, where the null hypothesis corresponds to random effects and the alternative to fixed effects (Greene, 2000):

$$\begin{cases} H_0: RE \\ H_1: FE \end{cases}$$

Detecting the random effect in the model implies that the individual-specific effect is a random variable and is uncorrelated with explanatory variables (exogeneity). The fixed effect model refers to the possible correlation of the individual-specific effect with explanatory variables (endogeneity). A model with fixed effects assumes that each unit of the population has its own specific individual characteristics, which for each particular object are constant in time. If the units of the set differ in their individual characteristics, but these differences are random, then in this case it is better to consider a model with random effects.

Additionally to the diagnosis of the individual effects and choice of the perfect fit model, this study will perform several robustness checks of the baseline model applying cluster-robust variances in order to account for potential heteroskedasticity and autocorrelation, testing the model for multicollinearity and reflecting the methodological changes in calculation of some components of the E-Government index by adding two interaction terms.

4. Empirical Analysis and Findings

Following the main aim and objectives of the research, this chapter presents an empirical analysis and achieved findings evaluating the effects of e-government implementation on economic and social development. Firstly, this study reports descriptive statistics of the data analyzing the means and standard deviations of e-government indices and main explanatory variables. Secondly, the research carried out correlation analysis that evaluates relationships between independent variables in general and relationships between e-government indices and economic and social development variables. Thirdly, the main trends of e-government development in Europe are described in order to understand the progress of electronic means in the public sector during the period of 2003 and 2014. Finally, this study presents a regression analysis of the panel data model and tests the robustness of the results achieved in the baseline model.

Additionally, this chapter deliberates on further effects of e-government development, namely on good governance practices, which were not part of the main model presented in this analysis.

4.1. Descriptive Statistics

The first step of the data analysis consists in analysing descriptive statistics, including the means and standard deviations of the model indicators. Descriptive statistics, presented in Table 4, were calculated for the dependent variables, for the main variables of interest and for control variables included in the study.

GDP growth among European countries is presented by 4.374 in average and ranges from 3.371 up to 5.036. The standard deviation is relatively small and is presented by 0.399 showing that economic development of the Member States of EU cannot be characterised by significant level of inequality. Regarding the Political stability and Health Index, it can be seen that both indicators are relatively homogeneous among the countries and represent the level of deviation by 0.592 and 0.058 respectively. With respect to Rule of Law, it can be concluded that public confidence in the police force and social policies varies among countries from -1.256 up to 2.121 with the standard deviation of 0.895. Considering the Under-five mortality rate, it can be seen that this indicator varies from 2.000 up to 23.700 and deviates by 4.361 from country to country.

The E-Government Development Index (EGDI) and E-Participation Index (EPI) are weighted average scores on the scale of 0 to 1. Their average scores are 0.678 and 0.389 respectively. These results show that in average the level of the development of electronic government among European countries is almost twice higher than the level of promotion of the electronic participation of citizens in decision-making processes. The standard deviation of E-Government Development Index is 0.121 and its values range between 0.311 and 0.916. E-Participation Index values are much more disperse, ranging between 0.017 and 1.000 and displaying a standard deviation twice higher (0.243) than the EGDI variable.

The table below presents, in addition, descriptive statistics of the components of the E-Government Development Index: Human Capital Index with 0,929 average score, Telecommunication Infrastructure Index with 0,529 average score and Online Service Index with 0,576 average score. The countries are relatively uniform in terms of Human Capital Index, but display important differences for the other two indices. Also in terms of the control variables, the sample countries seem to be relatively heterogeneous.

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP growth	238	4.374	0.399	3.371	5.036
Rule of Law	238	0.952	0.895	-1.256	2.121
Political stability	238	0.674	0.592	-1.988	1.660
Health Index	238	0.843	0.058	0.681	0.948
Under-five Mortality rate	238	6.809	4.361	2.000	23.700
E-Government Development Index (EGDI)	238	0.678	0.121	0.311	0.916
E-Participation Index (EPI)	238	0.389	0.243	0.017	1.000
Human Capital Index (HCI)	238	0.929	0.051	0.710	0.993
Telecommunication Infrastructure Index (TII)	238	0.529	0.207	0.049	0.887
Online Service Index (OSI)	238	0.576	0.179	0.083	1.000

Voice & Accountability (VA)	238	0.971	0.718	-1.770	1.826
Inflation	238	3.799	5.416	-1.611	59.218
Total Government expenditure	238	43.562	7.246	28.229	65.270
Population (log)	238	2.119	1.475	-1.234	4.974
Human Capital Index in 2014 (HCI2014)	238	0.123	0.303	0.000	0.962
Telecommunication Infrastructure Index in 2014 (TII2014)	238	0.098	0.246	0.000	0.887

Table 4. Descriptive statistics.

4.2. Correlation analysis

4.2.1. Correlation between independent variables

Table 5 presents a pairwise correlation matrix for the independent variables of the study. As it can be seen from the results, correlation between E-Government Development Index and E-Participation Index (0.724) turns out to be relatively strong. In order to test if multicollinearity is a problem, this study applied regression analysis without E-Participation Index in the base model and checks the robustness of the model adding the E-Participation Index in the sequel (see section 4.5.3. Multicollinearity check).

With regard to Telecommunication Infrastructure Index and Online Service Index, both indicators show a high correlation with E-Government Development Index, displaying the levels of 0.900 and 0.891 respectively. Together with Human Capital Index, these indicators are the components of the E-Government Development Index, therefore high correlations between them reflect their weights in the calculation of EGDI.

	E-Government Development Index (EGDI)	E-Participation Index (EPI)	Human Capital Index (HCI)	Telecommunication Infrastructure Index (TII)	Online Service Index (OSI)
E-Government Development Index (EGDI)	1.000				
E-Participation Index (EPI)	0.724	1.000			
Human Capital Index (HCI)	0.311	0.101	1.000		
Telecommunication Infrastructure Index (TII)	0.900	0.579	0.105	1.000	
Online Service Index (OSI)	0.891	0.762	0.227	0.632	1.000

Table 5. Correlation matrix for the independent variables.

Finally, both E-Participation Index and Online Service Index can be considered as demand and supply of electronic means to interact with public entities and the high correlation between these indices can be explained by their similar composition.

4.2.2. Correlation between e-government indices and economic and social development

Analysing further the correlations in the model, this study presents in Table 6 the correlation matrix between e-government development and economic and social development. Overall, the e-government development indices are found to have high positive correlations with indicators of economic and social development. The main variable of interest, E-Government Development Index, shows the highest magnitude of correlation with Rule of Law (0.802), Health Index (0.851) and Under-five mortality rate (-0.707). In addition, its correlation with the GDP growth that represents economic development indicator is also considerable high (0.625). Telecommunication Infrastructure Index is relatively strongly correlated with the indexes of economic and social development, particularly with Rule of Law (0.800), Health Index (0.883), Under-five mortality rate (-0.763) and GDP growth (0.691). Among the components that build up E-Government Development Index the lowest correlations can be seen between Human

Capital Index and the indicators, such as GDP growth and Political stability. Similarly to Human Capital Index, the E-Participation Index is presented as lower correlated with GDP growth and Political stability. From this analysis, it can be seen that E-Government Development Index has much more impact on economic and social development in comparison to E-Participation index that has noticeably weak relationship with corresponding variables.

	GDP growth	Rule of law	Political stability	Health index	Under-five mortality rate
E-Government Development Index (EGDI)	0.625	0.802	0.507	0.851	-0.707
E-Participation Index (EPI)	0.297	0.449	0.141	0.487	-0.399
Human Capital Index (HCI)	0.262	0.348	0.180	0.334	-0.314
Telecommunication Infrastructure Index (TII)	0.691	0.800	0.560	0.883	-0.763
Online Service Index (OSI)	0.391	0.598	0.327	0.605	-0.459

Table 6. Correlation between e-government development and economic and social development.

4.3. Trends of E-Government development in Europe

The last stage of the data analysis of this study presents the trends in development of E-Government Index and E-Participation Index among 34 European countries during the period from 2003 until 2014.

Calculating the average of both indexes for each year, Figure 3 shows that the E-Government is presented in Europe on more advanced level than E-Participation indicator and has two main periods of rapid growth – between 2003 and 2008 and between 2010 and 2012 as it was the period of active implementation of information technologies on governmental level for provision of online services for citizens and businesses and increasing its modernization level. The decrease between 2008 and 2010 reflects the global financial crisis characterized by low

investments in electronic development of the public sector. It can be also seen that during the period from 2012 until 2014 E-Government Development Index has a decline in its level, however, it can be explained by the 2014 methodological changes in calculating the component indices, namely the Human Capital Index and the Telecommunication Infrastructure Index. In general, E-Government Development Index has increased since 2003 until 2014 from 0.624 up to 0.722.

The E-Participation Index started its development with a rather small level of progress. Since 2003 until 2012 the level of the index has changed just from 0.332 up to 0.392. However, as it can be seen from the figure below, the highest jump in E-Participation trend was presented after 2012 with the change of the score from 0.392 up to 0.599. These results show that adaptation to new technologies by citizens and usage of electronic means in interacting with governmental organizations started just almost a decade after the introduction of electronic government in European countries.

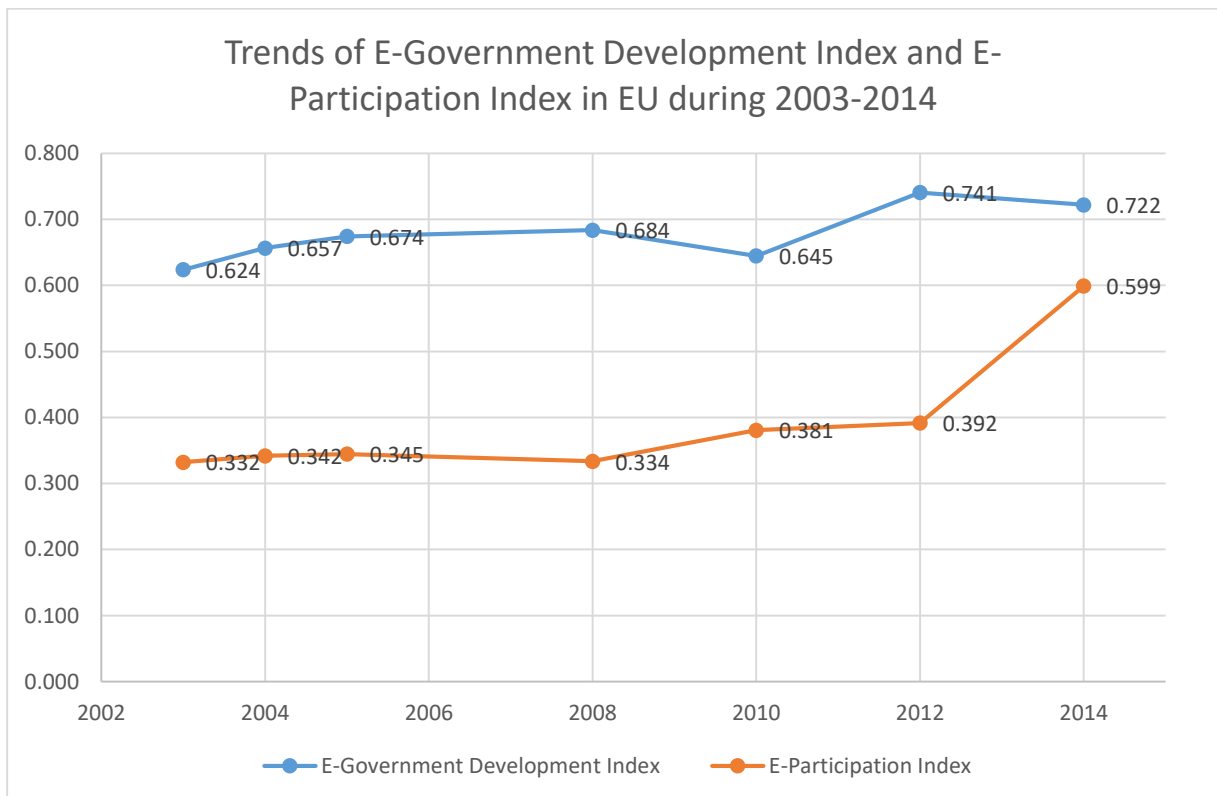


Figure 3. Trends of E-Government Development Index and E-Participation Index in EU during 2003-2014

Analysing in more detail the components of E-Government Development Index, see Figure 4, this study shows that the highest level among all three indicators is displayed by the Human Capital Index with the average increasing from 2003 until 2010 and decreasing from 2010 until 2014. This decline can be explained by large and persistent youth and adult unemployment rates during that periods that lead to skill attrition and depreciation in human capital (Banerji, A. et al., 2014). In comparison to the Human Capital Index, the other two components of E-Government Development Index have much smaller average scores across the European countries. Telecommunication Infrastructure Index presents steady growth with the biggest increase in its development after 2010. It can be seen that overall the telecommunication infrastructure has increased in the last decade, although slowly. This increase was made from 0.458 up to 0.685 in the average score since 2003 until 2014.

The most unstable growth is presented by the development of Online Service Index where the increase was made during 2003 and 2005 and between 2010 and 2012. The remaining time periods are characterized by the decline of the Online Service Index, particularly with the high decrease during 2008 and 2010. This dynamics shows that even having electronic means for interacting with citizens and businesses governmental organizations do not provide sufficient, relevant and updated information on their websites thereby constraining the communication.

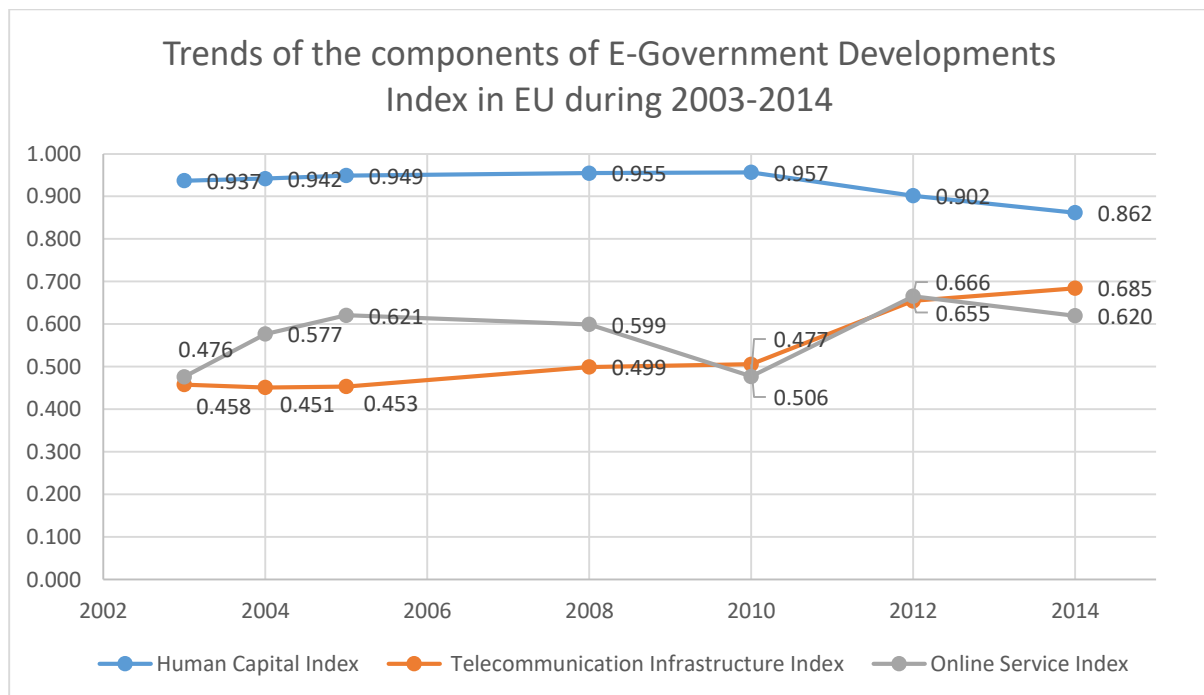


Figure 4. Trends of the components of E-Government Developments Index in EU during 2003-2014.

4.4. Regression analysis

For the analysis of the effects of e-government on economic growth and social development in European countries during the period between 2003 and 2014, this study applied 2 types of panel data models: the first type of models includes as the main independent variable the global E-Government Development Index and the second model analyses the effects of the components of E-Government Development Index separately. In order to avoid multicollinearity problem, E-Participation Index was excluded from the baseline model and added as a supplementary index to the E-Government indicators under section 4.5.3. Multicollinearity check.

[Models of type 1]:

$$GDPgrowth_{it} = \beta_0 + \beta_1 EGDI_{it1} + \beta_2 Voice \& Accountability_{it2} + \beta_3 \log(Population)_{it3} + \beta_4 Inflation_{it4} + \beta_5 TotalGovExpenditure_{it5} + \alpha_i + \varepsilon_{it}, \quad (11)$$

$$Social\ Development_{it} = \beta_0 + \beta_1 EGDI_{it1} + \beta_2 Voice \& Accountability_{it2} + \beta_3 \log(Population)_{it3} + \beta_4 Inflation_{it4} + \beta_5 TotalGovExpenditure_{it5} + \alpha_i + \varepsilon_{it} \quad (12)$$

[Models of type 2]:

$$GDPgrowth_{it} = \beta_0 + \beta_1 HCI_{it1} + \beta_2 TII_{it2} + \beta_3 OSI_{it3} + \beta_4 Voice \& Accountability_{it4} + \beta_5 \log(Population)_{it5} + \beta_6 Inflation_{it6} + \beta_7 TotalGovExpenditure_{it7} + \alpha_i + \varepsilon_{it}, \quad (13)$$

$$Social\ Development_{it} = \beta_0 + \beta_1 HCI_{it1} + \beta_2 TII_{it2} + \beta_3 OSI_{it3} + \beta_4 Voice \& Accountability_{it4} + \beta_5 \log(Population)_{it5} + \beta_6 Inflation_{it6} + \beta_7 TotalGovExpenditure_{it7} + \alpha_i + \varepsilon_{it} \quad (14)$$

In both types of the models:

$$i = 1, \dots, 34; t = 1, \dots, 7;$$

$Social\ Development_{it}$ is divided into sub-models: Rule of Law, Political Stability, Health Index and Under-five mortality rate.

Effects of e-government on economic growth and social development

Results of applied regression analysis of the effect of e-government on economic growth and social development are presented in the Table 7. The model of type 1 that aims to study the global effect of electronic government demonstrates the high level of its significance on all the indicators of economic and social development. E-Government Development Index has a strong positive impact on GDP growth, in particular, an increase of EGDI by 0.01 units accelerates the GDP growth by 0.00354 percentage points. Moreover, E-Government Development Index is statistically correlated with several indices of social development among European countries, such that an increase of EGDI by 0.01 units increases the level of Rule of law by 0.00916 pp, Political stability by 0.00389 pp, Health index by 0.00210 pp and decreases the Under-five mortality rate by 0.15154 pp.

The effects of other explanatory variables show relatively homogeneous impact, in particular, Voice and Accountability together with Total government expenditure have a significant impact on economic and social development. The index of Population has economically expected sign of its coefficients and the index of inflation does not have a significant effect in most of the cases.

For model of type 2, this study subdivided the E-Government Development Index into three components in order to specify which components have more impact on economic and social development in Europe. As it can be seen from the Table 7, Human Capital Index and Telecommunications Infrastructure Index have similar behavior with chosen set of economic and social indicators, affecting positively the GDP growth, Rule of law and Health index and decreasing the Under-five mortality rate at the same time. It can be seen that each 0.01 units increase in Human Capital Index increases GDP growth by 0.00334 pp, Rule of law by 0.00768 pp, Health index by 0.00101 pp and reduces the Under-five mortality rate by 0.11459 pp. Moreover, each 0.01 units increase in Telecommunications Infrastructure Index leads to the raise of GDP growth by 0.00354 pp, Rule of law by 0.00782 pp, Health index by 0.00168 pp and reduces the Under-five mortality rate by 0.13224 pp. On the contrary, the Online Service Index does not have any significant impact on economic and social development sub-indices.

The remaining explanatory variables have expected signs of coefficients and similar impact on economic and social development as in the first model.

Variable	Economic growth	Social development				
	GDP growth	Rule of law	Political stability	Health index	Under-five mortality rate	
Model 1	EGDI	0.354***	0.916***	0.389*	0.210***	-15.154***
	Voice & Accountability	0.058**	0.812***	0.415***	0.024***	-0.864*
	Population(log)	-0.067*	-0.066**	-0.169***	0.000	0.496*
	Inflation	-0.000	-0.002	-0.002	0.000	0.043*
	Total government expenditure	0.002**	0.009***	0.002	0.001***	-0.142***
	Constant	4.135***	-0.712***	0.272	0.620***	22.884***
	N	238	238	238	238	238
Model 2	HCI	0.334***	0.768***	0.607	0.101***	-11.459***
	TII	0.354***	0.782***	0.225	0.168***	-13.224***
	OSI	-0.016	-0.009	0.107	-0.001	0.275
	Voice & Accountability	0.081***	0.790***	0.392***	0.023***	-0.777*
	Population(log)	-0.042	-0.053**	-0.171***	0.003	0.245
	Inflation	0.000	-0.001	-0.002	0.000	0.036*
	Total government expenditure	0.000	0.005**	0.001	0.001**	-0.068***
	Constant	3.896***	-1.037***	-0.138	0.610***	27.374***
N	238	238	238	238	238	

* p<0.1, ** p<0.05, ***p<0.01

Table 7. Effects of e-government on economic growth and social development (baseline model with random effects).

Results obtained under the regressions analysis provide a significant evidence to confirm both hypotheses of this study, confirming the following:

H1: E-government development will positively influence on the GDP growth among European countries.

H2: E-government development will positively influence on the social development among European countries.

Comparing the results obtained during this analysis and the results from empirical researches in economic literature, we are able to agree with the recent study of Stanimirovic et al. (2013) and conclude about the positive impact of e-government development on economic performance and government efficiency in European countries. Similarly to the findings of some other studies (Corsi et al., 2006 and Baller et al., 2016) it can be seen that digitalization of government provides a higher efficiency of public administration and, in addition, better social policies with the subsequent effect on the social development of nations.

The base model of this study was presented in the form of panel data regression with random individual effects for each of the studied approaches. The choice of random effects model is explained in the next section under the robustness analysis.

4.5. Robustness checks and further effects

4.5.1. Fixed effects model

The regression analysis of this research was presented through estimation of the base model with assessed random effects assuming that the individual-specific effect is a random variable, which is uncorrelated with explanatory variables.

The choice between random and fixed effects models was made based on the results of performed Hausman test investigating whether the model residuals are correlated with the regressors or not. The results of Hausman test are negative, which in the econometric literature is described as “not an unusual outcome for the Hausman test” (StataCorp, 2001, vol. 2, p. 13). Negative results of Hausman test is a relatively frequent phenomenon in small samples and in most of the cases allows to “interpret this result as strong evidence that we cannot reject the null hypothesis” (StataCorp, 2017, p. 977). Thus, the random effects estimator is consistent and more efficient for the analysed sample. However, in order to perform the robustness check of the analysed model, this study applied the fixed effects model to the data sample and compared the outputs under different estimators.

Table 8 demonstrates the regression analysis of the base model with applied fixed effects:

Variable		Economic growth	Social development			
		GDP growth	Rule of law	Political stability	Health index	Under-five mortality rate
Model 1	EGDI	0.324***	0.474***	0.238	0.181***	-14.247***
	Voice & Accountability	0.027	0.371***	0.290**	-0.006	0.212
	Population(log)	-0.311***	-0.503**	0.474	0.009	13.384***
	Inflation	0.000	0.000	-0.004	0.000	0.038
	Total government expenditure	0.002**	0.006***	-0.005	0.001***	-0.137***
	Constant	4.699***	1.058**	-0.531	0.649***	-6.268
	N	238	238	238	238	238

Model 2	HCI	0.230**	-0.153	0.468	0.071**	-8.806***
	TII	0.312***	0.389***	0.161	0.153***	-12.576***
	OSI	-0.014	-0.044	0.078	-0.002	0.040
	Voice & Accountability	0.056**	0.416***	0.292**	0.008	-0.912
	Population(log)	-0.207**	-0.435*	0.555	0.052**	9.439***
	Inflation	0.000	0.001	-0.004	0.000	0.036*
	Total government expenditure	0.000	0.004*	-0.006	0.0005*	-0.068***
	Constant	4.376***	1.249**	-1.082	0.557***	5.333
	N	238	238	238	238	238

* p<0.1, ** p<0.05, ***p<0.01

Table 8. Effects of e-government on economic growth and social development (fixed effects model).

As it can be seen from the table above, the impact of e-government development under fixed effects estimator does not differ significantly from the random effects. E-Government Development Index positively affects the GDP growth by 0.00324 pp, Rule of Law by 0.00474 pp and Health Index by 0.00181 pp when increasing by 0.01 units. Under aforementioned increase, the Under-five mortality rate will decline by 0.14247 pp. Considering the components of E-Government Development Index separately, it can be also verified that their effects are similar to the base model. Human Capital Index and Telecommunications Infrastructure Index are observed to have the strongest relationships with the indicators of economic and social development in comparison to the remaining explanatory variables.

The main change that the fixed effects model demonstrates is a failure to provide an evidence of the impact of e-government indices on Political Stability. However, these results along with the low significance ($0.05 < p < 0.1$) of Political stability indicator in the base model lead to the conclusion of its weak correlation with the level of governmental digitalization.

4.5.2. Random effects model with cluster-robust variances

In order to check the robustness of the base model this study applied cluster-robust option to the random effects regressions treating each country as a cluster. This method provides a solution to account for potential heteroskedasticity and autocorrelation problems of analysed data sample (Wooldridge, 2013; Arellano 2003). Following clustering approach in order to obtain fully robust standard errors and test statistics, this study summarizes and presents the results in the following Table 9:

Variable		Economic growth	Social development			
		GDP growth	Rule of law	Political stability	Health index	Under-five mortality rate
Model 1	EGDI	0.354***	0.916***	0.389	0.210***	-15.154***
	Voice & Accountability	0.058	0.812***	0.415***	0.024***	-0.864
	Population(log)	-0.067*	-0.066**	-0.169***	0.000	0.496**
	Inflation	0.000	-0.002	-0.002	0.000	0.043
	Total government expenditure	0.002**	0.009***	0.002	0.001***	-0.142***
	Constant	4.135***	-0.712***	0.272	0.620***	22.884***
	N	238	238	238	238	238
Model 2	HCI	0.334***	0.768***	0.607	0.101***	-11.459***
	TII	0.354***	0.782***	0.225	0.168***	-13.224***
	OSI	-0.016	-0.009	0.107	-0.001	0.275
	Voice & Accountability	0.081**	0.790***	0.392***	0.023***	-0.777
	Population(log)	-0.042	-0.053	-0.171***	0.003**	0.245
	Inflation	0.000	-0.001	-0.002	0.000	0.036
	Total government expenditure	0.000	0.005*	0.001	0.001**	-0.068**
	Constant	3.896***	-1.037***	-0.138	0.610***	27.374***
N	238	238	238	238	238	

* p<0.1, ** p<0.05, ***p<0.01

Table 9. Effects of e-government on economic growth and social development (random effects model with cluster-robust variances).

As presented in the table the main results remain the same even with the added cluster option in the model. In the random effects model with cluster-robust variances the main variable of interest, E-Government Development Index, is statistically significant in most of the cases, in particularly positively affecting the GDP growth, Rule of law, Health index and reducing the Under-five mortality rate. However, similarly to results of the fixed effects model, E-Government Development Index loses a significant impact on Political stability indicator.

Considering the model of type 2 with separate components of E-Government Development Index, all the results of the variables of interest remain the same as in the base model, demonstrating positive significant effect of Human Capital Index and Telecommunication Infrastructure Index on GDP growth, Rule of law and Health Index and reducing decreasing effect on Under-five mortality rate.

On the other hand, some of the explanatory variables in certain scenarios change their significance, such as the impact of Voice and Accountability on GDP growth and Under-five mortality rate and the impact of Population on Rule of law and Health Index. However, the overall effect of the model remains the same and supports the conclusion that the results of the baseline model are robust.

4.5.3. Multicollinearity check

During the correlation analysis, this study has verified a relatively strong correlation between two e-government indices – E-Government Development Index and E-Participation Index (0.724). In order to avoid classic effects of multicollinearity problem, this analysis removed E-Participation Index from the base model and focused just on the impact of the main variable of the interest, on E-Government Index. However, this section aims to check the robustness of the model adding back E-Participation model and compares the outputs with the baseline model.

Table 10 demonstrates the results of regressions analysis with both indices included in the model:

Variable	Economic growth	Social development				
	GDP growth	Rule of law	Political stability	Health index	Under-five mortality rate	
Model 1	EGDI	0.416***	0.994***	0.803***	0.233***	-16.418***
	EPI	-0.033	-0.042	-0.240**	-0.009	0.723
	Voice & Accountability	0.060**	0.811***	0.393***	0.026***	-0.813
	Population(log)	-0.060*	-0.065**	-0.163***	0.0005	0.472
	Inflation	0.0003	-0.002	-0.003	0.0003	0.047*
	Total government expenditure	0.002**	0.009***	0.003	0.001***	-0.144***
	Constant	4.084***	-0.754***	0.080	0.609***	23.558***
	N	238	238	238	238	238
Model 2	HCI	0.324***	0.770***	0.463	0.105***	-11.577***
	TII	0.356***	0.774***	0.284*	0.168***	-13.186***
	OSI	-0.008	-0.020	0.265*	-0.003	0.391
	EPI	-0.012	0.016	-0.227**	0.003	-0.172
	Voice & Accountability	0.080***	0.788***	0.385***	0.024***	-0.787*
	Population(log)	-0.042	-0.054**	-0.165***	0.003	0.251
	Inflation	-0.0002	-0.001	-0.004	0.0001	0.036*
	Total government expenditure	0.0001	0.005**	0.002	0.0005**	-0.067***
	Constant	3.900***	-1.028***	-0.081	0.607***	27.408***
N	238	238	238	238	238	

* p<0.1, ** p<0.05, ***p<0.01

Table 10. Effects of e-government on economic growth and social development (multicollinearity check).

From presented results, it can be seen that, in general, the effect of the model of type 1 and the main variables of interest remains the same showing a positive significant effect of E-Government Development Index on GDP Growth, Rule of law, Political stability and Health Index and having a diminishing effect on Under-five mortality rate concurrently.

In the model of type 2, the main effects of the components of E-Government Index are similar to the results when E-Participation Index is not taken into account. Human Capital Index and Telecommunication Infrastructure Index are positively affecting the GDP growth, Rule of law

and Health Index and negatively affecting the indicator of Under-five mortality rate. Moreover, in this model Telecommunication Infrastructure Index and Online Service Index start to demonstrate a significant impact on Political stability that was not verified in the baseline model.

Comparing coefficients of regression analysis of both models, it can be seen that after adding E-Participation Index the regression coefficients do not change dramatically and remain similar to the main model of this study.

The main conclusion that can be drawn from multicollinearity check is that E-Participation Index does not have any significant effect on most of the variables of economic and social development. In models of both types, E-Participation Index has a negative significant effect just on the indicator of Political stability. From descriptive statistics, we have already seen that E-Participation Index is twice less developed in Europe in comparison to E-Government Development Index and its values are more disperse among the countries. Additionally, according to the study prepared by the Policy Department for Citizens' Rights and Constitutional Affairs of European Parliament (Lironi, E. 2016) implementation of E-Participation initiatives among Europe has several challenges that arise in the short and in the long terms. The main reason of ineffective usage of E-Participation tools is the European citizens' disinterest in EU-level politics based on the lack of trust in EU and its ability to solve the problems. Moreover, E-Participation tools are simply unknown for citizens due to the low level of its promotion. Both statistical and theoretical findings give a basis to explain achieved results of non-significance of E-Participation Index on economic and social development due to the low prevalence and popularity of E-Participation tools and initiatives in comparison to the instruments of E-Government.

4.5.4. Reflection of methodological changes in calculation of the Human Capital Index and Telecommunication Infrastructure Index in 2014

According to the UN E-Government survey, in 2014 two components of E-government Development Index have undergone some methodological changes in their calculation. From one hand, since 2003 until 2012 (particularly in 2003, 2004, 2005, 2008, 2010 and 2012) the Human Capital Index was including two key indicators: adult literacy and gross enrolment ratio. In 2014 the composition of Human Capital Index was broadened and included expected years of schooling and mean years of schooling. On the other hand, the Telecommunication Infrastructure Index was also changed in 2014 due to the substitution of indicators representing Users of Personal Computers and Fixed Internet subscriptions for the indicator representing Wireless broadband subscriptions. As a result of the applied changes, it will be reasonable to distinguish the data of Human Capital Index and Telecommunication Infrastructure Index in 2014 from the previous data.

In this section, the study introduces two interaction terms to reflect the methodological changes made in 2014 in two of the components of E-Government Index and checks if results of the baseline model are robust.

Firstly, the variable HCI2014 was introduced to represent the product of a time dummy variable multiplied on the Human Capital Index. Hence,

$$HCI2014 = HCI \times newyears,$$

$$where\ newyears = \begin{cases} 1 = year \geq 2014 \\ 0 = year < 2014 \end{cases} \quad (15)$$

Secondly, similarly to HCI2014, the variable TII2014 was included in the model and can be characterized by the product of the time dummy variable *newyears* multiplied by the Telecommunications Infrastructure Index.

Finally, the regression analysis was made including the two new interaction terms in the baseline model with random individual effects. The output of this regression analysis can be seen in the Table 11:

Variable		Economic growth	Social development			
		GDP growth	Rule of law	Political stability	Health index	Under-five mortality rate
Model 2	HCI	0.417***	1.323***	-0.024	0.177***	-14.436***
	TII	0.346***	0.751***	0.336*	0.163***	-12.595***
	OSI	-0.013	0.004	0.068	0.001	0.064
	Voice & Accountability	0.081***	0.791***	0.382***	0.024***	-0.786*
	Population(log)	-0.042	-0.058**	-0.164***	0.003	0.270
	Inflation	0.000	-0.001	-0.004	0.000	0.028
	Total government expenditure	0.000	0.005**	0.001	0.0004*	-0.073***
	HCI2014	0.036	-0.154	-0.797***	0.012	-4.440***
	TII2014	-0.026	0.318*	0.831***	0.002	4.755***
	Constant	3.815***	-1.532***	0.464	0.542***	30.206***
	N	238	238	238	238	238

* p<0.1, ** p<0.05, ***p<0.01

Table 11. Effects of e-government on economic growth and social development (reflection of methodological changes in calculation of the Human Capital Index and Telecommunication Infrastructure Index in 2014).

Applied approach to reflect the methodological changes in Human Capital Index and Telecommunication Infrastructure Index does not change coefficients of the baseline model radically. It can be seen that Human Capital Index and Telecommunication Infrastructure Index retain their positive significant effect on GDP growth, Rule of law and Health Index and negative significant effect on Under-five mortality rate. Moreover, the model with added interaction terms demonstrates a change in the effect of one of e-government components: Telecommunication Infrastructure Index turns to have a positive effect on Political stability assuming the level of significance of 10%. The remaining variables maintain similar effects, such as Voice and Accountability saves its significant effect on all the indicators on economic and social development and just the indicator of Inflation loses its significance in relation to Under-five mortality rate.

Results of this section showed that the overall effects presented in the baseline model did not change dramatically and inclusion of two new interaction terms to reflect the methodological changes in Human Capital Index and Telecommunication Infrastructure Index has further strengthened the confidence in robustness of the main model presented in this study.

4.5.5. Further effects of e-government development

The findings of this study show that implementation of electronic government among European countries leads to a significant positive change in economic and social development of the nations. It has been verified that e-government has the potential to increase GDP growth and improve social environment due to its impact on the principles of the rule of law, political stability and indicators of health and child mortality. These results were achieved due to regression analysis based on the approach that evaluates a direct effect of introduction and development of e-government. However, it is important to note that the value of electronic government can be also evaluated indirectly.

Development of new information and communication technologies in governmental processes plays an important role in achievement of good governance goals. Sharing the same objectives, e-government and good governance are aimed to achieve better administrative efficiency, strategic and equitable resource allocation, better quality of public services provision, democratic participation and transparency. This idea finds support in several researches (Islam, 2003; Von Haldenwang, 2004; Madzova et al, 2013; Alaaraj and Ibrahim, 2014 along with others) that focus on evaluation of the effect of e-government implementation on good governance. Haldenwang justifies the reason of adopting electronic government as the main channel of good governance and explains it through the dualistic approach of state modernization: from one side, it has an internal focus on administrative reform; from another side, it has an external focus on relationships between state and citizens (Von Haldenwang, 2004). Alaaraj and Ibrahim in their theoretical research framework empirically examine the effect of e-government on good governance in the Lebanese case and identify that e-government positively and significantly influence good governance. In particular, e-service represented as one of domains of electronic government has a strong positive impact on effective governance due to its potential to improve service delivery and convenience of

interaction in state-citizen relationships. Finally, accessibility of information at a very low cost and better information flow support achievement of fundamental goals of good governance, such as transparency and openness of the public sector (Madzova et al, 2013; Islam, 2003).

This study examines the three most important broad dimensions of good governance among six dimensions presented by the World Bank and performs a regression analysis evaluating the impact of digital government on the following indicators:

- **Control of corruption** that reflects the extent to which the public power is exercised on obtaining private gain, including diversion of public funds, irregular payments, levels of petty and grand corruption, its frequency, as well as public trust in politicians.
- **Government effectiveness** that measures the quality of public and civil services, including the effectiveness of administrator institutions, adequacy of budgetary and financial management, level of bureaucracy and independence of provided services from political interference.
- **Regulatory quality** that captures perceptions of the ability of public administrations to implement effective policies and strategies in order to promote private sector development, better business regulatory environment and market-friendly government policy. This indicator evaluates the ease of starting new businesses and barriers to enter the market for goods and services by new competitors, including the stringency of local regulations.

Table 12 presents the results achieved during the regressions analysis indicating the main effects of e-government on the chosen set of good governance indicators:

Variable		Good governance		
		Control of corruption	Government effectiveness	Regulatory quality
Model 1	EGDI	0.415**	0.511***	0.367**
	Voice & Accountability	0.974***	0.857***	0.836***
	Population(log)	-0.038	-0.030	-0.006
	Inflation	0.001	-0.005*	-0.003
	Total government expenditure	0.003	-0.005*	-0.004*
	Constant	-0.359	0.156	0.181
	N	238	238	238

Model 2	HCI	1.317***	1.299***	0.962***
	TII	0.540***	0.794***	0.497***
	OSI	0.016	-0.165*	-0.083
	Voice & Accountability	0.946***	0.819***	0.793***
	Population(log)	-0.034	-0.017	-0.003
	Inflation	0.000	-0.006**	-0.003
	Total government expenditure	0.000	-0.010***	-0.007***
	Constant	-1.467***	-0.813**	-0.510*
	N	238	238	238

* p<0.1, ** p<0.05, ***p<0.01

Table 12. Effects of e-government on good governance.

The model of type 1 demonstrates significant and positive relationships between E-Government Development Index and all indices of good governance. In particular, an increase of EGDI by 0.01 units increases the Control of corruption indicator by 0.00415 pp, Government effectiveness by 0.00511 pp and Regulatory quality by 0.00367 pp. Considering the impact of other independent variables, the strongest significant effect on good governance is provided by the indicator that measures the level of Voice and Accountability.

For the model of type 2, this study subdivided the components of E-Government Development Index and as it can be seen from the model, the greatest impact on good governance is presented by Human Capital Index and Telecommunication Infrastructure Index. Each increase in Human Capital Index by 0.01 units raises Control of corruption by 0.01317 pp, Government effectiveness by 0.01299 pp and Regulatory quality by 0.00962 pp. Similarly, Control of corruption increases by 0.00540 pp, Government effectiveness by 0.00794 pp, Regulatory quality by 0.00497 pp when Telecommunication Infrastructure Index raises by 0.01 units.

5. Conclusion and Policy Recommendations

This research set three main objectives in order to evaluate the impact of e-government strategy on the development of nations.

Firstly, building the panel data model based on the information collected from 34 European countries during the period of 2003 until 2014 and performing correlation and regression analysis, this study demonstrated positive significant relationships between e-government implementation and economic growth and social development. Thus, both hypotheses that were put forward in this study has been confirmed showing that e-government development positively influence GDP growth and social development among European countries. Obtained results confirm previous findings in the literature (Stanimirovic et al., 2013; Corsi et al., 2006 and Baller et al., 2016) supporting the idea of positive effect of introduction and adoption of digital technologies in government on economic performance of the countries and provision of better social policies. Additionally, the evidence from this research confirms the achievement of the main goal presented in the European eGovernment Action Plan 2011-2015 and the European eGovernment Action Plan 2016-2020 and demonstrated empirical results of the implementation of the digital government among European countries, such as modernization of public administration and enabling its efficiency and effectiveness.

Secondly, direct benefits of e-government strategy were investigated based on estimation of several types of models and analysing the global impact of electronic government and the separate impact of it components. It was found that E-Government development has a positive effect on GDP growth and several social indices, such as Rule of law, Political stability, Health index and a negative significant impact on Under-five mortality rate. Analysing which components of e-government provide more benefits for countries' development, it was shown that both Human Capital Index and Telecommunications Infrastructure Index positively affect the GDP growth, Rule of law, Health index decreasing the Under-five mortality rate at the same time.

Finally, basing on the empirical model results this research determines the following policy recommendations for the advancement of the effects of e-government strategy:

a) Continuous development of e-government policies

Successful implementation and adoption of e-government strategy on the national level should be regarded as a continuous process, including not just an investment in provision of necessary telecommunication infrastructure and electronic tools but also active promotion of potential benefits of digitalization and continuous enhancement of citizens' and businesses' in the usage of new ICT capacities by raising the level of informational literacy of the population. This study demonstrated the disparity between the demand side and the supply side of the digital government. It was shown that the level of e-government development is almost twice higher than the level of e-participation. Implementing e-government policy it is important to support "the new way" of provision of the information and public services and help public employees and the general public to adapt to new technologies. Formation and provision of training programs for various social and age groups of the population and performance of national campaigns promoting advantages of such digitalization can help to accelerate adoption of electronic government and increase its efficiency.

Analysing the example of the United Kingdom that implemented one of the most developed e-government strategy among European countries, it can be seen that these successful results were achieved through continuous advancement of e-government. Since 2000, the Government of the United Kingdom presented several E-Government policies and strategies transforming public services using information and communications technologies and outlining the effectiveness of the use of technology. Government Digital Inclusion Strategy launched in 2014 is focused on the increase of the digital involvement helping people to be capable to use and benefit from the digital government. Following this strategy, the Government of the United Kingdom performs comprehensive analysis of the digital capabilities and skills of the population and provides training where needed to fill any gaps.

Therefore, in order to achieve continuous development of e-government policies, e-government should be developed focusing on the needs of the population of all categories by continuous analysis of these needs in different life and business situations. An analysis of current and future requirements and expectations of the population is required, the necessary support and training needs to be provided.

b) Political commitment towards e-government strategy

European Union has implemented a comprehensive regulation framework that covers all the critical areas of e-government strategy, such as data protection and privacy, users' identification, interconnection of business registers, standards of electronic invoicing and payment services, telecommunication services, re-use of public data, public procurement and others. However, all governments should establish a national legal framework in compliance with European directives and regulations that will focus on supporting and provision of the means to develop effective e-government system. It is necessary to prepare a system of normative legal that are consistent and govern all aspects of information exchange between public authorities, citizens and business entities.

Additionally to extension of regulative framework, successful implementation of digital government requires establishment of a coordination system in order to improve the quality of decisions made at all governmental levels and to tighten control over their execution. The coordinating authority should continuously analyse the level of realization of e-government programs, allocation of resources and performance management and report the results to the highest levels within the governmental hierarchy.

Finally, the governments of European countries should act as the initiators of innovation processes in the public sector, provide the legal and financial framework for innovation, identify innovative priorities and areas of its implementation and, moreover, it is important for the governments to become first customers, primary users and demand makers of ICT technologies when performing their official duties.

c) International cooperation for the development of digital government

Despite the fact that European Union has implemented integrated framework programs to support e-government strategy, figures regarding the development of digital government present a large disparity even among the EU member states. Referring to UN E-Government survey (2016) the average level of E-Government Development Index, for example, in Northern Europe is 65.85% higher than in Eastern Europe. This inequality of ICT development in public sector slows down creation of the digital single market across the Europe, therefore, preventing

citizens and businesses from fully taking advantage of e-government and economic and social benefits it provides.

In order to ensure that implementation of digital government functions as efficient as possible, international cooperation is needed to bridge the gap between more and less digitally advanced societies. Such cooperation should be based on provision of various consultancy projects, and international conferences that will aim to strengthen e-government policies due to the exchange of ICT skills, knowledge and experience in order to contribute to economic and social development of European countries. International cooperation will ensure that governments save money by not reinventing the wheel, will facilitate provision of cross-border digital services and achieving economies of scale.

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