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UNDERGRADUATE THESIS

Evaluation and benchmarking of E-Government policies and applications

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**ΣΧΟΛΗ ΘΕΤΙΚΩΝ ΕΠΙΣΤΗΜΩΝ
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ΠΤΥΧΙΑΚΗ ΕΡΓΑΣΙΑ

**Μέθοδοι Αξιολόγησης πολιτικών και εφαρμογών
Ηλεκτρονικής Διακυβέρνησης**

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ΑΘΗΝΑ

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ABSTRACT

E-Government is a new and promising research field engaging various academic fields from computer, social and political science. Evaluation and benchmarking of E-Government policies, applications and services has not been thoroughly analyzed yet. However, there is proof that is critical for any E-Government implementation. There are many difficulties and issues to be tackled as diverse aspects and factors have to be studied before a concrete outcome can be assessed. An analysis of the existing methods and frameworks reveals the complexity of the multidimensional process and the necessity of further research. A comparison of the most important ones exposes interesting differences and concerns. Better and wider frameworks are needed for more accurate and reliable results.

SUBJECT AREA: E-Government

KEYWORDS: E-Government, evaluation, benchmarking, frameworks, impact, value

ΠΕΡΙΛΗΨΗ

Η Ηλεκτρονική Διακυβέρνηση είναι ένα νέο και πολλά υποσχόμενο ερευνητικό πεδίο που ενδιαφέρει τις κοινωνικές και πολιτικές επιστήμες αλλά και την επιστήμη των υπολογιστών. Η συγκριτική αξιολόγηση των πολιτικών, εφαρμογών και υπηρεσιών Ηλεκτρονικής Διακυβέρνησης δεν έχει ακόμη διερευνηθεί σε βάθος. Ωστόσο, υπάρχουν επιστημονικές αποδείξεις ότι είναι απαραίτητη για κάθε υλοποίηση Ηλεκτρονικής Διακυβέρνησης. Υπάρχουν αρκετές δυσκολίες και προβλήματα που πρέπει να επιλυθούν καθώς διαφορετικοί παράγοντες και δεδομένα πρέπει να μελετηθούν πριν εξαχθεί ένα ασφαλές αποτέλεσμα. Μία ανάλυση των υπάρχουσών μεθόδων και μοντέλων αναδεικνύει την πολυπλοκότητα της πολυδιάστατης διαδικασίας και την ανάγκη περαιτέρω έρευνας. Η σύγκριση των πιο σημαντικών παρουσιάζει ενδιαφέρουσες διαφορές και προβληματισμούς. Καλύτερα ευρεία πλαίσια αξιολόγησης μεγαλύτερου εύρους χρειάζονται για πιο ακριβή και αξιόπιστα αποτελέσματα.

ΘΕΜΑΤΙΚΗ ΠΕΡΙΟΧΗ: Ηλεκτρονική Διακυβέρνηση

ΛΕΞΕΙΣ ΚΛΕΙΔΙΑ: ηλεκτρονική διακυβέρνηση, αξιολόγηση, επιπτώσεις, σύγκριση, αξία

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PROLOGUE

Since I was a child, I can clearly remember that, two things attracted me as anything else. Those two things were so impressive and captivating that whenever I saw or heard them instantly my attention was brought to them. Growing up my interests varied from times to times but always those two things came to conquer any new interest and become once again my beloved ones. The first was the image of 16-bit colours moving around in huge screens only by moving a strange device with a wire and a heavy ball underneath called the “mouse”. Another weird machine with keys decorated with letters and numbers making a strong sound called “keyboard” looked so intriguing. Those first computers I saw back at the end of 90’s immediately touched my heart and made me feel a true lover of their amazing science, computer science. The second was the voice of mostly old men talking to microphones in front of thousands of people and making them shout and clap. They were called “politicians” and were presenting their dreams about societies, called policies. Since the first I remember I was impressed.

Later, when I had to choose which science I would like to study, I knew very well that only one could fulfill my scientific queries and help me discover more and more of existing knowledge. That was the science of computers. And what about policies and politicians?

I knew that I had to study something on that too. Even if I had chosen something very different than political sciences and I was always persuaded that my beloved computer science would not let me down. It existed in every other science I knew and it was expanding to more and more. That was enough for me to research further and discover a whole new scientific field combining Computer Science and policies, the well-known but not yet researched enough, Electronic Government or E-Government.

E-Government is a very interesting academic field combining the use of computer science in order to improve government and governance. In a world changing with very high speeds, driven by new technological innovations and inter-connected via Internet, governments have also to modernize their operations and their offered services. Various projects and policies have been planned and implemented until now creating diverse impressions. As a result, a realistic evaluation of them seems quite compelling. It is really attractive to study how an E-Government project and a broader policy for digital government can be evaluated and compared with others from other countries around the globe.

After researching existing academic literature for more than 7 months in order to identify important E-Government milestones, explore current research issues and discover future challenges, in January 2016 my undergraduate thesis is ready to be submitted in order to become a solid basis for further research. Evaluation and benchmarking is a complex but crucial domain of any E-Government initiative and thus the journey until now was laborious but fruitful.

Regarding the technical aspects of this paper, it has to be underlined that there was a need to study a sizeable amount of academic papers concerning the evaluation and benchmarking. Basic theory, such as the important evaluation categories, were analyzed and are presented. Evaluation criteria, levels and aspects are also introduced in order to show how an evaluation is structured. Value is also well defined, as it is a core part of every evaluation.

Moreover, the three most important and common frameworks used for E-Government evaluation and benchmarking are presented with details and are compared up to the degree that they can be compared. Remarks and suggestions coming after that are presented and concerns are raised. Further research is proposed before some final commentaries.

To conclude, with this thesis some more academic analysis is brought to an interesting scientific field that has a lot of knowledge to provide to modern societies.

1. INTRODUCTION

1.1 Definition of Electronic Government

One of the modern inventions that changed radically our lives and societies is the global system of interconnected computer networks, the Internet. Billions of fixed and mobile devices worldwide are linked and communicating through the Internet Protocol Suite. Using desktop, laptop, tablet computers or smartphones, it is estimated that 3,270 billion people, at around 40% of the world population, are using Internet nowadays [1].

Realizing this, many governments across the world are transforming into new forms of government called electronic government [2]. As West mentions, few developments have had broader consequences for the public sector than the introduction of the Internet and digital technology. Electronic government or E-Government offers the promise of utilizing technology to improve public sector performance as well as employing new advances for democracy itself. In its boldest formulation, technology is seen as a tool for long-term system transformation [3]. Information and Communication Technologies combined with organizational changes and new skills are used in order to improve public services, enhance democratic processes and strengthen support to public policies [4]. However, what really is electronic government and how can all these digital and social phenomena happen so suddenly?

E-Government is a wide term that has many definitions, broader and narrower, specific and more general alike. Usually, it is defined as the delivery of government information and services online through the internet or other digital means [5]. This definition focuses on the information and services available through the World Wide Web, named as “front-office”. However, E-Government is not only what is visible to the public, but also the diffusion of technology within public administration to give rise to an emerging genre of web enabled public services that are sensitized to citizens’ modern transactional requirements [6]. According to OECD, it can be considered as the process of innovation of public administration in order to achieve innovative forms of government and governance through the use of Information and Communication Technologies (ICTs) [7].

Moreover, Dawes gives us a sense of the multidimensionality of the term when she states that it is “the use of Internet technology to support government operations, engage citizens, and provide government services” [8]. The first of these, government operations, primarily involves management practices that, although critical for any function, are largely invisible to the public [9]. This is the reason why E-Government is also defined as “the use of information technology to enable and improve the efficiency with which government services are provided to citizens, employees, businesses and agencies” [10]. In the years of abundant information and overflowing data, it is about delivering improved services to citizens, businesses, and other members of the society through drastically changing the way governments manage information [11], as by transforming its service delivery approaches. It will also better connect with citizens while attaining operational efficiencies [12].

In general, in terms of policy, technology and organizational management, E-Government is seen as an innovation because it redefines and improves government transaction processing via a sophisticated IT platform [13].

1.2 Types of E-Government services and applications

E-Government services and applications are complex, diverse and have a broad extent. They can be categorized in many ways according to various criteria. Scope, intention, expected outcome, range of use and level of implementation are only some of them. Depending on needs, resources and sophistication there are many examples in existing literature of diversified categorization. Due to the extensive number of possible implementations in each country, categories can be abundant.

The most prominent and mostly used model of categorization contains 3 main categories. Their difference is determined according to the end users and intentions of E-Government applications and services.

- G2C or Government to Citizen

The first main category of E-Government implementations encloses applications and services created in order to be used by citizens. These are made in order to facilitate day-to-day citizens' operations and transactions with public services, which consume an important amount of time in modern life. Citizens' connection with state is usually hampered by time and consuming bureaucracy. As has been examined in depth in many research studies, national economies lose billions of dollars each year due to excessive bureaucracy. As a result, firstly and most importantly E-Government intends to reduce time and paper used and improve every transaction, in different stages and complexities.

- G2B or Government to Business

The second category contains applications and services implemented to serve business needs. All enterprises – small, medium and large – interact in a daily basis with public services for various reasons. These interactions are expensive, time-consuming and need a human being to perform them. So, their total cost is high and difficult to handle. As a result, it needs to be lowered in a constructive and fruitful way. G2B E-Government tools aim to make government – businesses relationship more effective and efficient as transactions should be simpler, quicker and less expensive. Reduction of bureaucracy makes starting and running a company easier and cheaper. So it promotes entrepreneurship creating economic growth, jobs and prosperity.

- G2G or Government to Government

The third category of E-Government applications incorporates all applications used to enhance internal intra-government operations. Information sharing, documents exchange, identification, security and procurement are some of the most prominent operations that state service perform among themselves as parts of their duties. Digital Government makes them digital and interconnected, eliminates the need of paper and signatures. It drastically reduces human, financial and time resources needed to accomplish goals.

The aforementioned three main categories include all E-Government services and applications and form the main basis for further improvement and evolution of E-Government policies. They almost define Digital Government and explain its extent, usability and importance.

Later will be analyzed thoroughly the significance of identifying the end user of each application and adapt it to the appropriate needs, as user satisfaction is considered crucial in the digital age.

1.3 Examples of use

The implementation of E-Government services can take various forms, ranging from a single website with contact information (address, telephone and fax numbers, email address, etc.) of a public organization to an interactive, consolidated gateway to integrated services at all levels of government, from local to federal or national [14]. Websites are not any more the only option for E-Government services public access, as many governments are developing interactive smartphone applications. Depending on the needs that each E-Government service comes to fulfill and the depth of sophistication of the system many different approaches can be found around the globe. As a result, there are numerous examples of E-Government applications implemented to support diverse public services to citizens, businesses, government organizations and of course the promotion of public policies and national interests.

First of all, the simplest E-Government applications are the websites providing information about government organizations, such as ministries and public offices, their people and their duties. Location locator is usually provided to inform users where a point of interest, like a school or office, is. Information provision can be also used to attract tourists in the region administered by the website owner, by offering virtual tours of sights, and to promote local beauties and businesses.

Furthermore, transportation and traffic information, gas and basic products' prices are also common. When information is broader and deeper, potential investors can be updated about financial and legal frameworks of the district and citizens can browse police related information. Some government organizations also broadcast live their official meetings, legislative sittings etc.

One of the most important and promising E-Government service is OpenData. It is the systematic publication of all government data at a specific website, in order to improve transparency and accounting. Through this, citizens are able to browse and search for legislation, decisions, regulations, spending and registries.

Moreover, citizens can obtain various permits, renew licenses, like driver's license, make automatic registrations to various lists, such as a "Do not call me" list, and submit change of personal details like the address. They can also demand or issue certificates and receive information regarding their insurance, retirement plan or check the status of a pending application.

Calculating and paying taxes and fines is a common E-Government service provided by an increasing number of governments in the world. Taxation management is one of the most important tasks for each government and each citizen too and digital technologies have changed it thoroughly. Calculation of inflation and exchange rate is often provided too, as well as abroad registration and passport application.

Of course, citizens can interact with administration and politicians by asking, commenting, completing various surveys or registering their complaints. Public consultations on serious issues are another political procedure that E-Government facilitates allowing to any citizen to participate regardless of distance and mobility matters.

Another common E-Government service is job posting websites where and digital applications for them. Businesses can post their career offers and citizen can review and apply for them.

Businesses utilize many more E-Government services that make their everyday operation more effective and efficient. E-Government is potentially one method of both

promoting collaboration with businesses through digital means, but it also is a way to monitor and regulate business; with collaboration being important for public administration [15].

At first, entrepreneurs can quickly access information about legislation regarding starting a new business and submit the appropriate applications. Existing businesses can use taxation management applications to handle successfully their complex tax obligations and schedule their forthcoming. In addition, they can register their services and their products for quality testing, selling permit and tax labeling. Employee registration, insurance and payment benefits can be clarified and digitally calculated. Custom declarations can be quickly submitted online as well as changes of contact information and scheduling of public services inspections [16].

Thus, apart from their informative role, e-government web sites are as much about online services as they are about public participation [17]. Electronic voting is another E-Government innovation that offers paperless elections and digital participation even from the most distant location. E-procurement provides fair, open and transparent procurement procedures for fulfilling public needs.

By examining diversity and variety of examples around the globe, we can assume that E-Government has seen much potential to change the way that governments interact with their citizens [18]. Also, implementation policies significantly affects public sector organizations in terms of changes in organizational structure, business processes and organizational culture at organizational and inter-organizational level [19].

However, the e-Government challenge is not a technological one. Rather, the challenge is to use technologies to improve the capacities of government institutions, while improving the quality of life of citizens by redefining the relationship between citizens and their government [20]. Though, E-Government provides obvious benefits to governments, professionals, and organizations, it is citizens who actually predicted to receive a number of benefits [21].

Some examples presented below measuring their presence in the 193 member states of the United Nations [22]:

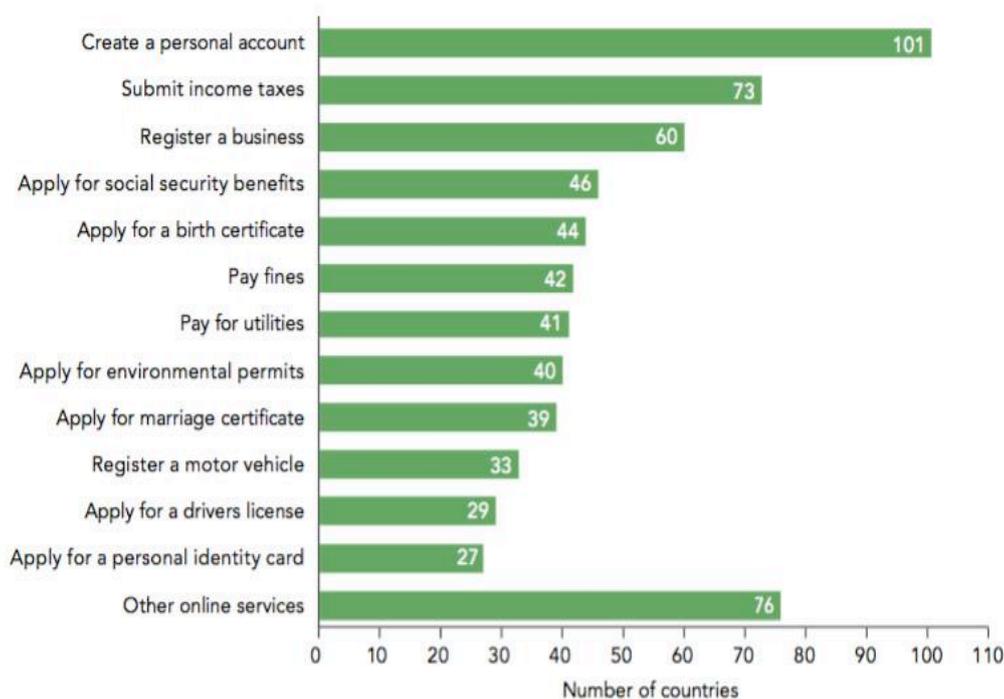


Figure 1: Examples of E-Government services in UN countries

1.4 Channels of Electronic Government Delivery

Various channels are used to deliver E-Government services and applications to all the people, leaving no one behind including disadvantaged and vulnerable groups, as an integrated inclusive multichannel service delivery approach is, therefore, central to the successful implementation of E-Government policies. According to the International Telecommunication Union, almost 40 per cent of the world's population are online by the end of 2013 and mobile phone subscriptions exceeded 6.8 billion in October 2012 approaching global population of 7 billion. Moreover, there are more than 2 billion mobile broadband subscriptions by the end of 2013 with a growth rate of 40 per cent per annum.

Public sector is under pressure to transform itself in order to respond to changes and radically explore new ways to meet citizen demands. Channels extend from traditional citizen touch-points like counter and voice services, to online means like Internet access through personal computers, mobile phones and tablets. Emerging media like mobile applications and social media are also used. As a channel can change users' perception, confidence and trust of a public service, it is extremely important to select the right channel for the right service targeting the specific audience. At the same time, channel selection is a deciding factor to effectively reach out to specific groups of citizens, for example, rural population with limited ICT access.

Digital channels, with both their diversity and spread, are increasingly embraced by almost all countries, while counter (face-to-face service) and telephone (voice) services, have continued to serve as fundamental channels as preferred by some citizen groups. Through strategic and optimized mixed use of channels, governments will be able to provide ubiquitous 24 x 7 access to information and services to different user groups. A non-exhaustive list of most common channels used is the following [22]:

1. Web portal
2. Email
3. SMS and other messaging services

4. Mobile portal (website)
5. Mobile application
6. Social Media
7. Public Kiosks
8. Intermediaries through public-private partnership

1.5 Advantages of Electronic Government

The implementation and use of Electronic Government services and applications has numerous advantages for citizens, businesses and the government itself.

First of all, E-Government facilitates enhanced and wider citizen participation in political processes and so reduces social exclusion and strengthens democracy. Online participation thus reflects greater confidence in government, and a greater share of user-citizens who observe transparency in E-Government, a crucial democratic value. Existing research shows that there is a relationship between e-government and citizen satisfaction [23] and trust in government is actually increased [18]. It is anticipated that greater transparency and responsiveness in government will transform public administration in ways that include lower political corruption rates, as the greater proportion of EU citizens that interact, fill out forms, and report user centricity on their home government websites is linked to lower perceptions of corruption [24].

The following presents the number of countries of the United Nations providing procurement announcements, evaluations and results online [22]:

Table 1: UN countries providing procurement information online

	<i>Number of Countries</i>	<i>% of total countries</i>
National portal(s) providing an e-procurement platform or a link to e-procurement announcements for bidding processes	63	33%
National portal(s) providing information about results of procurement/bidding processes	55	28%
National portal(s) providing any information about monitoring and evaluation of existing procurement contracts	33	17%
National portal(s) indicating an online tracking system for transactions such as applying for grants, permits etc.	54	28%

Moreover, it improves information sharing between services and agencies. The introduction of ICT within business processes lowers communication time and costs [25]. Changing the medium of message transportation from paper into a digital format reduces paper handling costs, speeds up message transportation time and standardizes interfaces and message structures. Malone et al. refer to operational benefits like direct (transaction) cost savings, enhancement of data quality and productivity improvement of administrative tasks as to the electronic communication effects of ICT [16]. It also enables automated data transfer between systems, thus supporting the coordination of inter- and intra-organizational processes. This electronic integration effect [25] reduces data transformation costs between systems and organizations. making government operations less expensive in resources, more efficient and effective.

It provides greater variety, choice and convenience of access for customers of public services, making them more equal and readily accessible, as well as improved speed of the processes which underpin them [26].

Furthermore, small businesses, the majority of businesses in most economies, are the main drivers of economic innovation and new job growth. E-Government reduces economic cost of transactions to businesses as it simplifies information obligations that impose a major administrative burden on all businesses.

Companies devote considerable resources to administration, regular tax declarations, managing the social security status of their employees, or applying for permits to carry out their business. These compliance costs hamper economic growth in general and burden smaller companies in particular [27], as government regulation can be considered a principal/agent problem under information asymmetry, with the government as the principal and the individual businesses as agents [28]. The reduction of the administrative burden¹ on businesses has become an important policy theme. Main drivers behind 'Better Regulation Programs' are the assumptions that a stronger focus on the reduction of the administrative burden on businesses will lead to better policies, better implementation, better compliance and ultimately, better government [29]. This development of ICT based solutions and services aims to reduce the amount of time that it takes a business to perform a certain activity by reducing search, communication and transaction times [29]. The elimination of paper handling costs and the reduction of wait and search times sum up to savings capacities per company and further to macro savings opportunities per type of message per year. Also, similarly to the trust in government literature for citizens, there also is a relationship between perception of trust and confidence by businesses in government and e-government satisfaction [30].

Therefore, improving users' satisfaction with public service delivery is very important for economic development [31]. As a result, E-Government can be used as a tool to promote economic development, since it will enable businesses to more effectively transact with government [32].

The introduction of ICT within business processes lowers communication time and costs [25]. Changing the medium of message transportation from paper into a digital format reduces paper handling costs, speeds up message transportation time and standardizes interfaces and message structures. Malone et al. refer to operational benefits like direct (transaction) cost savings, enhancement of data quality and productivity improvement of administrative tasks as to the electronic communication effects of ICT [16].

In addition, Gribnau [33] argues that a key development in governance is a shift away from hierarchy to networks with continuing interaction between interdependent actors in order to exchange resources and negotiated shared purposes, problems, and solutions. The collaborative nature of the new governance is conveyed in the move from command and control to negotiation and persuasion [28]. So, the use of new technologies is supposed to strengthen government legitimacy as well as to boost the efficiency and effectiveness of government policies [34].

¹ The administrative burden can be defined as the (recurring) costs of administrative activities that businesses are required to conduct in order to comply with the information obligations that are imposed through central government regulation [29]

1.6 Categories of E-Government Applications

E-Government applications are usually categorized in two main categories depending on the outcome they intend to provoke after their implementation and use:

The first category is composed by applications that are government's provision of services, known as e-services. According to Stahl, the use of the term e-government corresponds with the concept of e-service that includes "those aspects of public administration that have to do with the tasks of the executive" [35]. Those tasks are some of the core tasks of each state public services, provided, additionally or exclusively, on-line though, like regulation information, certificate form filling and taxation management. Many examples of e-services are given at previous section of this paper.

The second category contains applications that are government's attempts to engage citizens in political procedures or listen their voice and are known under the concept of e-democracy. Online provision of services can be part of the democratic process, e-democracy implies a process where citizens have on-line input and influence on policy decisions [35]. This involves different features of digital government, that is, the establishment of channels of communication and public outreach. It allows the public information and access to legislative networks and other areas of policymaking. While an important goal of e-government is to improve citizens' lives by providing faster and more efficient services, there is a wider goal of increasing citizen participation in the process of governance and administration [36].

The recent emergence of cutting edge information and communication technologies (ICTs), often called Web 2.0, has led to a new trend in the citizen-government relationship [37]. Modern web 2.0 applications facilitate even more democratic participation via digital means as already mentioned before, introducing the idea of e-participation. It refers to the ability of citizens to have access to information and to the promotion of participation in public decision-making. The e-participation axis refers directly to the EU thesis that "e-government strategies at all levels should advance trust and confidence in public services and online democratic participation" [4]. Moreover, one of the five priorities adopted by the EU in the i2010 e-Government Action Plan is the strengthening of participation and democratic decision-making, demonstrating by 2010 tools for effective public debate and participation in democratic decision-making [38]. e-Participation emerges as a priority also at a global level. The UN suggests a three-step plan for enhancing e-participation, namely:

- increasing e-information to citizens for decision making;
- enhancing e-consultation for deliberative and participatory processes; and
- supporting e-decision making by increasing the input of citizens in decision making [39].

Correspondingly, OECD defines three levels of participation: information, consultation and active participation [40]. Information is a one-way channel that informs citizens about a variety of available resources; consultation is a limited two-way channel; while active participation is a more enhanced two-way channel where citizens have more power over policy formulation, for example, by proposing certain policies [41].

One more component of e-democracy concept is citizen sourcing. The new ICTs are characterized by their bi- and multidirectional digital connections, which enable citizens to engage in collective decision-making and to collaborate on a task via online networks. Some government agencies now base policymaking and service production on input from the public. This phenomenon as a new trend is called citizen-sourcing, where sourcing refers to "how government departments and agencies obtain the

services they need to solve their mission delivery requirements and how those decisions are reached” [42]. Only some researchers and practitioners are using the citizen-sourcing concept such as Dutton in [43], but a variety of practices that we may consider citizen-sourcing are happening on government agency webpages and social media sites [44].

1.7 E-Government implementation stages

Darrell West maintains that Internet technology generally develops in four discrete stages [45]:

- 1) the billboard stage,
- 2) the partial service-delivery stage,
- 3) the portal stage with fully executable and integrated service delivery, and
- 4) interactive democracy with public outreach and accountability features.

It is the implementation of the last stage, that is, e-democracy, that holds the greatest potential for transformational change [9].

E-Government during the years of its evolution has been developing in various stages according to the point of view of researchers and their particular interest for specific domains of the progressive procedure. According to the literature the most important timeline moments of staging are the following.

Firstly, one of the earliest e-Government development classifications, created by featured four stages:

- 1) cataloging,
- 2) transaction,
- 3) vertical integration, and
- 4) horizontal integration.

At the cataloging stage, the website provides an online presence with cataloged information (e.g., phone numbers and addresses) and downloadable forms. A transaction stage website offers online transactions, supported by a database (e.g., citizens may renew their licenses and pay fines on-line). A website at the vertical integration stage links local and higher-level systems (e.g., a drivers' license registration system at a state department of motor vehicles is linked to a national database of licensed truckers). At the final horizontal integration stage, the website assimilates different functions and services across government agencies (e.g., a business can pay its unemployment insurance to one state agency and its state business taxes to another state agency, using the same interface or without uploading information several times) [46].

Secondly, United Nations Division for Public Administration and Development Management (former United Nations Division for Public Economics and Public Administrations) and the United Nations, in their studies, they described E-Government service development in five different stages:

- 1) emerging (where an official government online presence is established),
- 2) enhanced (where government websites increase and information provided becomes more dynamic),
- 3) interactive (where users can download forms, email officials and interact through the websites),

4) transactional (where users pay for services and conduct other transactions online), and

5) seamless (where e-services are fully integrated across administrative boundaries) [47].

In their 2010 e-Government survey, the United Nations (2010) merged “interactive” with “transactional” and renamed “seamless” as “connected”, establishing a four-stage order of emerging, enhanced, transactional, and connected [48].

Thirdly, the four-stage, e-Government service development presentation of Affisco and Soliman creates the following order:

- 1) publishing (where exists some web presence),
- 2) interacting,
- 3) transacting, and
- 4) transforming (where full integration exists) [49].

According to this classification, a website at the publishing stage presents only static information, while one at the interacting stage has features such as form download, search, and simple data collection. At the transacting stage, the website features online task processing without a requirement that citizens travel to the relevant offices. At the transforming or integration stage, a single-point portal integrates all e-Government services by all branches of government at all levels. The first two stages are “relatively easy to achieve, as supplying information, application forms and email addresses online involves no great effort or any change in existing operations. The development of the real transaction services, however, “is more difficult, requiring significant investments in back-office systems” according to Kunstelj and Vintar [50].

A table comparing various stage models by [14]:

Table 2: Stage Models comparison by [14]

A comparison of classifications of the stages of e-Government development.

(Layne & Lee, 2001)	(United Nations, 2008; UNDPEPA, 2002)	(United Nations, 2010)	(Affisco & Soliman, 2006; Al-adawi et al., 2005)
Cataloging	Emerging	Emerging	Publishing (web presence)
Transaction	Enhanced	Enhanced	Interacting
	Interactive	Transactional	Transacting
	Transactional		Transforming (integration)
Vertical integration	Seamless/networked	Connected	
Horizontal integration			

In general, as E-Government websites advance through the stages, according to the United Nations “they pass through many thresholds in terms of infrastructure development, content delivery, business re-engineering, data management, security and customer management” [48].

However, a direct mapping of stage to number in order to use it as an identifier of sophistication and difficulty of implementation and resources and effort needed (i.e., publishing=1; interacting=2; transacting=3; and transforming = 4) assumes that consecutive levels of e-Government development are equidistant. Such assumption may understate the value of the higher stages of development. For example, a website that jumps from stage 3 to stage 4 may have to undergo tremendous changes requiring massive efforts and resources compared to the transition from websites from stage 1 to stage 2. Further research is necessary to confirm this and cannot be used as a benchmark tool [14].

A graphical representation of E-Government stages, as well as the communication channels between governments and users, as described by the United Nations at [22]:

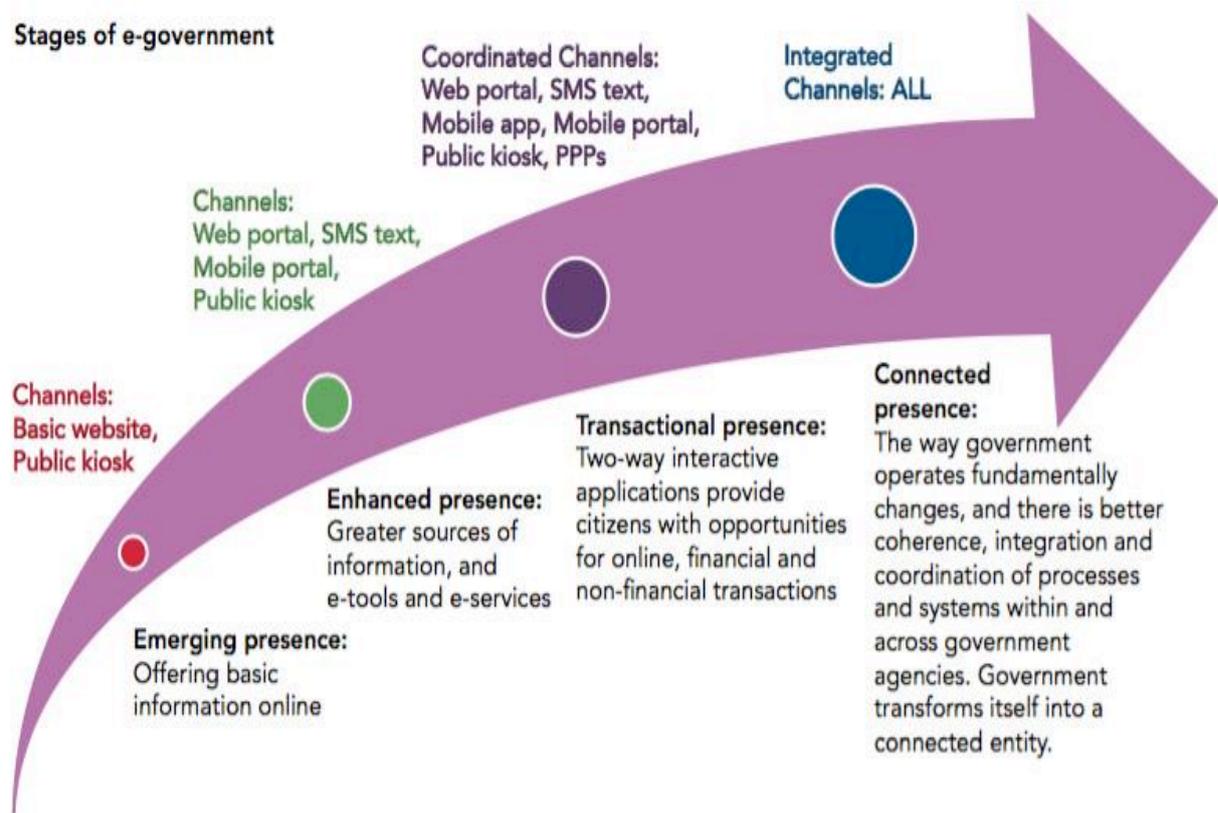


Figure 2: UN stages and channels

1.8 Electronic Government worldwide statistics

There are many research studies and surveys providing statistics about various topics of Electronic Government applications and services. They are widely used from many researchers, politicians and other stakeholders in order to indicate an objective status of different E-Government issues around the world.

United Nations occasionally perform an E-Government survey containing many interesting statistics about various E-Government indexes in countries and regions of

the globe. The latest to the moment of composition of this paper is [22] of 2014. According to the United Nations, in 2014 for the first time, all 193 United Nations Member States now have national websites, as shown below:

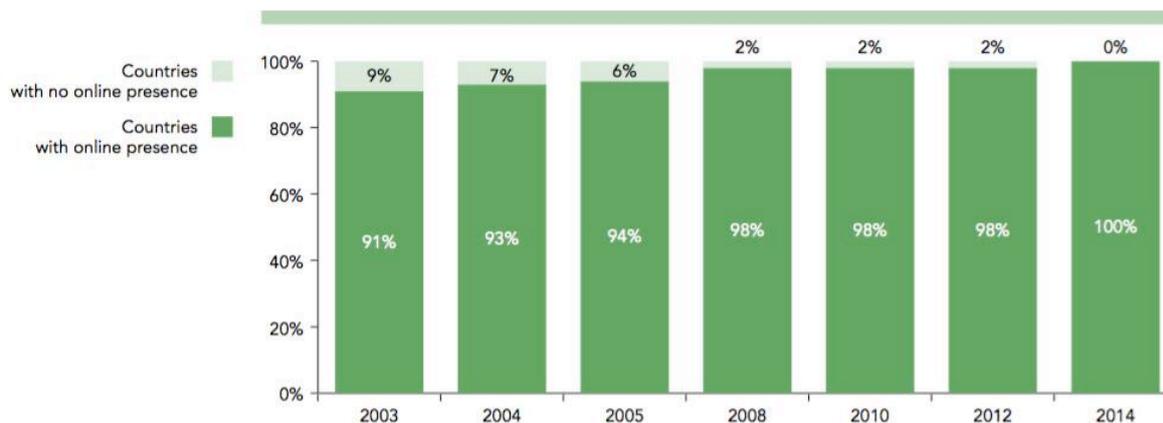


Figure 3: UN countries online presence in 2014

The majority of them remain at the low or intermediate levels of E-Government development, termed emerging and enhanced stages in the United Nations four stage online service model as the following tables [22] indicate regarding the number of countries providing selected basic features:

Table 3: UN countries providing basic online features

	<i>Number of countries</i>	<i>Per centage of countries</i>
Find website using search tools	168	87%
Site updated within past three months	148	77%
Access in more than one language	142	74%
Availability of map/index	131	68%
Help/FAQ feature	89	46%

And the number of the United Nations countries providing selected enhanced features:

Table 4: UN countries providing enhanced online features

	<i>Number of countries</i>	<i>Per centage of countries</i>
Advanced search option	101	52%
Privacy statement	97	50%
Tag cloud or 'hot topics'	80	41%
Secure website	53	27%

In terms of usability features, a large majority of countries provide users with basic search tools to locate content, and most now do so in more than one language. However, only about half of the United Nations Member States maintain an advanced search engine, only 40 per cent enable user opinion features, such as tag clouds and 'hot topics' lists and less than one third show the availability of a secure connection. There also appears to be substantial underutilization of the potential of text-based Short Message Service (SMS) despite the dramatic global growth of mobile devices usage, including in the low income countries. The most frequently found transactional services include setting up of personal online accounts, income tax filing and business registration, but overall there is great diversity in types.

Although the use of email increased only slightly between 2012 and 2014 to just over two-thirds of countries, it is likely to continue to grow in the future, especially for notification and information provision. Similar uses are seen for SMS via mobile devices, although still more than 80 per cent of countries have not yet exploited this potential mass channel which is only a slight advance from 2012. As far as the use of mobile phones themselves are concerned, there are today over 1.5 billion smart phones in use globally, and this is growing exponentially.

Between 2012 and 2014, the number of countries offering mobile apps and mobile portals doubled to almost 50 countries, where they are often used directly to support poverty eradication, gender equality and social inclusion, as well as promote economic development, environmental protection and disaster management. The use of social media by governments is also increasing fast with the number more than tripling from 2010 to 2012 and with another 50 per cent rise in 2014, so that today 118 countries use it for e-consultation and 70 for e-government generally.

Both social media and mobile channels typically do not require high investment costs as they ride on consumerization and non-governmental platforms, but they often need a business transformation and strong commitment in the public administration to maximize benefits.

There is also an increasing use of public kiosks from 24 countries in 2012 to 36 in 2014 for use as open-access facilities in public spaces and locations providing free use of online services, especially in marginalized or remote areas and where the individual use of ICT is not widespread. Similarly, both over the counter and telephone services remain fundamental channels with the majority of countries providing at least some services using these routes. They are often seen as important supplements for individual problem solving compared to, for example, websites, which are generally better at providing information.

By 2014, 64 per cent of the national government portals and websites provided integrated links to sources of archived information (policies, budget, legal documents, etc.) related to some disadvantaged and vulnerable groups, namely people living in poverty, persons with disabilities, older persons, immigrants and youth.

The 2014 Survey found that while many countries use government websites to share data, only 46 countries have dedicated data portals. Most main government sectors are making OGD available and most of this is in machine-readable format. Apart from the provision of OGD, there is a need to develop appropriate policy, legal and institutional frameworks to ensure that basic rights to information are available and well known.

The 2014 Survey shows that progress in e-government development has been attained through increased e-participation, growth of the mobile channel and social media, expanded usage and the burgeoning of open government data.

Some more statistics provided by the United Nations at [22] at the following tables:

Table 5: Countries with online portals with links to ministries

	<i>Countries with no links to ministries</i>	<i>Countries with 1–5 Links</i>	<i>Countries with 6–10 Links</i>	<i>Countries with more than 10 inks</i>
Africa	14	9	4	27
Asia	2	3	3	39
Europe	2	0	3	38
Americas	2	2	2	29
Oceania	6	3	0	5

Table 6: Use of electronic identity management feature [22]

	<i>Electronic Identity Management</i>	
	<i>2012</i>	<i>2014</i>
Number of countries	52	69
Global per centage	27%	36%

2. EVALUATION AND BENCHMARKING OF E-GOVERNMENT

2.1 Definition of Evaluation and Benchmarking

Implementing E-Government applications and services is a challenging process that requires many resources in human, financial and political capital. Evaluating the results and benchmarking the outcome of Digital Government projects is crucial for successful adoption, continuous improvement and further evolution of E-Government in any case. However, what evaluation and benchmarking are and how can they be done?

Benchmarking compares two or more institutions or entities using a set of indicators. It has long been used to evaluate and improve businesses. The first benchmarking activity was conducted at Xerox, leading to the adoption of processes that helped the company lower costs and improve performance [51]. Benchmarking indices and indicators are generally quantitative in nature, and collectively form a framework for assessment and ranking. Some frameworks are based on measurable characteristics of the entities; others use one or more subjective measures; a few employ a combination of both. Frameworks based on grounded and broadly applicable measures tend to attract fewer criticisms. Those based on subjective measures often result in controversies and complaints, especially from those countries or institutions who believe that they were not accurately characterized. To maximize the acceptability of results, rankings should be based on well understood and supported frameworks and indices, and sound computational procedures.

Benchmarking and rankings are commonly used to determine relative standing and to monitor the progress of entities with respect to a characteristic or achievement goal. E-Government benchmarks are used to assess the progress made by an individual country over a period of time, and to compare its growth against other nations. Indices are benchmarking and ranking tools that retrospectively measure the achievements of a class of entities, such as government agencies or countries, in the use of technology [14].

For policymakers, benchmarking tools, such as West's e-Government index, serve as information sources and the relative rankings of countries they produce are given a fair amount of attention and importance. To inform sound policy and decision making and to encourage optimal resource allocation, grounded and broadly applicable ranking frameworks are crucial [14].

2.2 Reasons for Evaluation and use of results

It is fair to say that there is no universal or standard process to assess E-Government initiatives and outcomes. There is widespread usage, however, of a few current approaches which to varying degree have overlapping conceptual frameworks, indicators and measures. On one hand, researchers and practitioners recognize the need for flexibility in assessing particular needs, establishing goals, and monitoring progress in the public administration of unique environments. On the other, lack of consistent and holistic frameworks of analysis obstructs agreement on best practices and models that reflect common guiding principles and democratic values [24]. One of the major challenges is determining how best to measure and assess the value with the same method covering stakeholders from both public and private domains [52].

The most important reason for evaluation is measuring users' satisfaction. Satisfaction with E-Government can be defined as the ability of citizens to get the information they

desire and have a service experience that solves their problems. Essentially, when citizens are satisfied they are able to accomplish their task at hand. This is important to know because satisfaction with E-Government is said to drive its use. As Cohen underlines in [23] greater satisfaction will lead to more use of E-Government and increase its future development [30]. Citizen online use and government website usability reflect also user perceptions about transparency and corruption. As a result, evaluations of overall E-Government capabilities are associated with different measures of usage, transparency, and public corruption [24].

Furthermore, public administrations in fact aims at producing value for citizens; from this perspective, the use of ICTs to improve governance is a means to improve the production of public value, which will be further analyzed later in this paper. Thus, an e-Government initiative resulting from a process of technological and organizational innovation can be indirectly evaluated by considering the possible increase of public value deriving from the adoption of the e-Services provided [53]. A growing number of studies benchmark national and municipal government websites in respect to delivering services and information, fostering public trust, and bringing citizens closer to government [54].

Moreover, E-Government project failures could have been prevented or at least mitigated by appropriate evaluation in the course of their conceptualization and planning [55]. Less failures save financial, human and time resources in public projects, which are mainly funded by taxpayers' money. Benchmarking can help governments and other institutions responsible for the implementation of e-Government services monitor the efficiency and effectiveness of public spending [56].

Evaluation results are used by decision makers when devising information and communication policies and allocating resources to implement those policies. Policymakers and researchers use e-Government benchmarking studies to help monitor implementation of e-Government services, using the information to shape their E-Government [57]. The results of benchmarking and ranking studies, particularly global projects conducted by international organizations, attract considerable interest from a variety of observers, including governments [58]. The United Nations at their survey [48] uses the Web measure index, another e-Government benchmark, in the hope that it "provides Member States with a comparative ranking on their ability to deliver online services to their citizens" (p. 15) and that it "could be [a] useful tool for policy-planners as an annual benchmark" [47].

Given the widespread use of benchmarking results by policymakers, practitioners, and funding agencies, future work should continue our focus on mitigating the various limitations of frameworks used to compute e-Government indices and to produce rankings. A continuous assessment and reconsideration of e-Government benchmarking frameworks is crucial for sustained improvement [14].

From a greater perspective, a focused assessment of E-Government (and other initiatives such as e-commerce, e-education, e-health, and e-science) is essential if a country is to make substantial progress [59]. Kaylor, Deshazo, and Van Eck point out that "an important aspect of the development of E-Government is assessing the trajectory it takes" [60]. Benchmarking serves as such an assessment tool for general country progress, as benchmarks "can have a significant practical impact, both political and potentially economic" [61] and can influence the development of e-Government services [50]. Rankings that result from benchmarking studies have been used by some countries to justify spending on e-Government initiatives [62].

At the international level, information and communication technology (ICT) indicators (part of e-Government benchmarking), "are critical to cross-country comparisons of ICT

development, to monitoring the global digital divide and to establishing policy-relevant benchmarks,” as long as they are comparable [63]. Public policymakers can use benchmarking indicators to design ICT policies; businesses can use them to compare their products and services to those of their competitors; researchers can use them to assess the impact ICT use has on productivity; and the international community can use them for cross-national or cross-country comparison of adoption and implementation of ICT [63], but also for worldwide conditions and policy comparisons, such as growth.

Thus, benchmarking e-Government serves both internal (where the beneficiary is the individual or organization conducting the benchmarking) and external (which benefits users of benchmarking studies) purposes. Its benefits fall into three categories:

1. to measure retrospective achievement (which helps policymakers compare how their country or agency ranks in terms of e-Government);
2. to chart prospective direction/priorities (which policymakers can use to make strategic decisions and identify appropriate courses of action) and to measure e-Government progress/development; and
3. to make governments and their agencies accountable for the investments in E-Government [57].

Benchmarking evaluations should be extended to include other means of access and/or delivery of e-Government services, such as digital television, mobile technologies, and telecenters. Other approaches, advocated by researchers such as Kunstelj and Vintar at [50], attempt to assess the impact of e-Government on the economy, on social and democratic processes, and on organizations and their work methods.

2.3 History of E-Government Evaluation

Among the first organizations to propose an e-Government index and rank countries on the basis of their e-Government service delivery was the United Nations Division for Public Economics and Public Administration at [47]. The United Nations followed up revisions and other proposals, such as [39], [56] and [22]. Others have also contributed proposals for benchmarking e-Government like West at [3] and [5], Bannister at [61], Ojo, Janowski, & Estevez at [59] and e-readiness, such as United Nations at [48].

Over the years, benchmarking methods and frameworks devised for businesses have been adopted by and/or applied to public sector and government institutions. National and international researchers in both the private and public sectors have created a variety of benchmarking mechanisms to evaluate the progress of e-Government at the local, national, regional, and global levels (e.g., United Nations in 2010, 2008, 2005, 2004 and 2003; UNCTAD in 2009 and West in 2004 and 2007).

The United Nations and the International Telecommunication Union (ITU) currently lead the way in benchmarking studies that are wider in scope and longitudinal in nature. This is due to their greater mandate, role, and capacity to collect, analyze, and disseminate the relevant data and results. The ITU produced the 2009 ICT development index in response to calls by member states to “provide policy makers with a useful tool to benchmark and assess their information society developments, as well as to monitor progress that has been made globally to close the digital divide” [58].

The more sophisticated benchmarking tools require expensive data collection and complex processing. For that reason, more e-Government benchmarking studies focus on supply-side not back-office [62]. The success of any benchmarking study is partly dependent on the availability of relevant data. As long as a country has some

governmental presence on the World Wide Web, mechanisms (framework 1) and others based on this framework (e.g., frameworks 2 through 6 and other Web-based indices) can be applied [14].

In the case of the EU, its e-Government benchmarks are simple, inexpensive, fairly transparent and replicable, and widely accepted and used [64], as benchmarking plays a “quasi-regulatory ” role, especially for members of the European Union where benchmarking is routine [64].

Many researchers fully support these more comprehensive approaches, but remain steadfast in the belief that frameworks based on simple, grounded, and broadly applicable measures serve well as the basis for building more complex frameworks that account for additional factors such as technology adoption and use [14].

In general, when studying about evaluation and benchmarking three types of references are usually used: Firstly, purely theoretical papers aiming to develop some kind of conceptual framework for the evaluation of e-government policies. Secondly, research efforts developed up to the degree of pilot application. Thirdly, indicator models developed in the practice for the practice (which is practical application) [65].

2.4 Definition of Value in Evaluation of E-Government

Main purpose of each evaluation process is to determine the amount of value of the project under evaluation. Value of E-Government projects combines both the private and the public sectors' perspective.

The concept of public value, which refers to the “value created by government through services, law, regulations and other actions” [66]. The policies for e-Government can be evaluated according to their ability to increase the public administration capacity of producing public value [67].

According to Moore and Moore at [68], exist three quite different conceptions of public value:

One conception involves the standard proposed by utilitarianism and welfare economics: public value equals the sum of individual satisfactions that can be produced by any given social system or governmental policy. It is this standard that we apply when we size up public policies in terms of the greatest good for the greatest number.

A second conception of public value is the idea that public value is whatever a duly constituted government acting as an agent of its citizenry declares to be an important purpose to be pursued using the powers and assets of government. This is the standard used when we claim that public officials ought to be concerned with achieving the purposes they have been mandated to achieve through legislative action.

A third conception of public value lies somewhere between these first two: public value consists of important purposes that can enhance the degree of individual satisfaction enjoyed by members of a polity that will not necessarily be achieved by competitive markets operating by themselves, and which the polity has assigned government to help them achieve collectively for their individual benefit. In this conception, government is specially authorized and required to deal with a particular set of conditions where markets will not function well to maximize the sum of individual satisfactions.

Cordella and Bonina at [69] also suggest that the qualities of public sector organizations are assessed on the basis of their ability to deliver the expected value to the citizens and not only by their value-for-money ratio. Generating public value for citizens through

services depends on the level of quality with which they are delivered in terms of: service availability, satisfaction levels, importance, fairness of provision and cost [66].

Regarding private value, when talking about private sector value, we normally relate to business value or firm value, e.g., cash flow, earnings or turnover. Indeed, money is the main equalizer of private sector valuation. Profit, revenue (turnover), cash flow, economic value added (EVA), net present value (NPV), and return on investment (ROI) are possible forms of business valuation [70]. In a private market, value is created when a business uses resources (labor and intellectual, physical and financial capital) to deliver returns to shareholders, as the ultimate goal of a business is pro fit/shareholder value maximization: by producing goods/services that can be sold above the cost of production. Thus, most private sector valuation forms are inevitably related to economic value and measured in monetary terms. In general, the economic value of something is how much a product (product should be interpreted as physical good) or service is worth to someone relative to other things (often measured by money). It can be either an evaluation of what it could or should be worth or an explanation of its actual market value (price).

Except public and private value, there are also diverse proposals in assessing overall E-Government evaluation results. The common denominator of various approaches is the following set of value categories for value assessment: financial value, social value, operational value, and strategic/political value. Economic value is created when there is a financial return on an investment. Social value is created when resources, inputs, processes or policies are combined to generate improvements in the lives of individuals or society as a whole [52].

2.5 Methods of Evaluation and Benchmarking

As mentioned at previous section of this paper, there is not a unique or specific system when evaluating E-Government projects and policies. Each researcher and institution has a different approach combining various variables and indicators. According to the needs of each evaluation there are significant differences among used methods. In general, there are some distinct categories that studies can be classified. The identification and characterization of the key evaluation aspects and evaluation levels within E-Government policies are very important, as well as the appropriate choice of variables and indicators in order to evaluate its development and effects.

2.5.1 Front-office

The first group is the so called “Front-office” evaluation. Benchmarks of this category are numerous and very well-known. They are all primarily focused on the web site analysis, using completely different indicators (from measuring 20 specific e-government services to web-based analysis of national portals, particular ministry portal etc.). Maturity of provided services is evaluated and compared.

The front-office area is studied from two complementary points of view: supply and demand. Supply-side approaches entails evaluating online supply, and only in individual cases does it also involve supply via other channels of communication such as digital television, mobile technologies, call centers, dedicated kiosks and so on. These approaches generally investigate availability, level of development, quality and other characteristics of individual websites, and portals as well as particular e-services and information content. On the other side demand-side approaches study the field from the point of view of the users (citizens and businesses). This kind of research primarily

involves investigating actual use of websites, portals, e-services, information content and other elements of supply, the level of interest in use and reasons for not using services as well as evaluations of the quality of services as perceived by the users and evaluation of their perceptions, requirements and needs [50].

On the European Union level the most known benchmark measurements have been conducted by Capgemini 2009, 2010 and 2011 [71], while the most renowned benchmark measurements on the global scale have been carried out by the United Nations [22], Accenture and Brown University [45]. According to UNDPEPA at [47], a country's level of progress with respect to e-Government is partly dependent on the presence or absence of specific website features and services. e-Government benchmarking studies that focus on online service delivery, sometimes called supply-side or front-office studies, rely on indicators such as the number of online services available to citizens and businesses, and the percentages of government departments with websites and websites that offer electronic services [62]. As long as these factors account for the stages of e-Government service development, they present a straightforward and objective assessment of a country's online sophistication [47].

West at [72] contributes to the discussion of benchmarking by proposing an e-Government index measuring the output or supply side of a government's web presence - the extent to which particular national websites provide a number of features and executable services. West's framework is considered among the more holistic because it accounts for the contents of e-Government websites and the e-Government services provided [17]. This more comprehensive nature addresses one of the recommendations made by Kunstelj and Vintar at [50] - avoiding piecemeal evaluation. West's framework does not account for the stages of e-Government service development and the level of citizen/user usage or satisfaction of citizens.

The approach of the United Nations at [48] and UNDPEPA at [47], which does not consider weights proportional to the stages of development of e-Government. A weight proportional to the stage of development rewards countries who provide a fairly sophisticated set of online services. It must be noted, however, that the process of assigning weights undercuts objectivity - it is mainly a subjective process dependent on the judgment of the individual doing the evaluation [54].

At the same group, some important benchmark measurements dealing with e-readiness or so-called E-Government readiness which could form the basis for planning of the necessary infrastructure for e-government development are: The Global Information Technology Report of the World Economic Forum [73], Digital economy rankings of the Economist [74], Measuring the Information Society of ITU [58] and United Nations e-Government Survey [56]. These benchmark measurements deploy different sets of indicators for benchmarking e-readiness and information society in general (e.g. Network Readiness Index from The Global Information Technology Report consists of three sub-indexes, while Digital economy rankings measure e-readiness on the basis of more than 100 qualitative and quantitative indicators). These indicator models are supposed to be rather extensive, hardly providing applicable guidelines, which countries could rely on in the process of further e-government readiness improvement and accomplishing better e-government effectiveness [65].

The indicators from those indicator models despite being popular are not unanimously supposed to be precise enough to ensure comprehensive evaluation and validation of e-government policies on the national level, as there is serious criticism to them, such as by Bannister at [61].

2.5.2 Back-office

The research that has dealt with evaluating the back-offices has assessed the adoption and use of different information systems including data sharing and exchanging technologies (databases, document management, process and workflow management, data sharing and exchange between organizations, etc.) [50]. Various organizational forms are examined in order to assess the outcome of use of new systems. Administrative efficiency before and after the implementation of E-Government policies is also evaluated.

Methods of cooperating within and between individual administrative bodies are widely examined, such as level to which a process is carried out electronically, level of integration of processes within life-events, level of process standardization, the number of different employees and institutions involved in the execution of the processes and life-events and the number of processes within particular life-events [50].

Back-office evaluation is rather more complex than Front-office and sophisticated methods used in evaluation of information systems impact are used, like stochastic frontier approaches [75], and Information Technology Performance Management (IT-PM) indicators [76].

2.5.3 General impact

Approaches to effects and impact evaluation include assessments of the impact of e-government on economic, social and democratic processes, such as cost and benefit analyses, impact on organization, work methods, complexity and human capital needed etc. Also, convenience, simplicity and accuracy of services provided to customers is evaluated [50].

Ex-ante and ex-post evaluations of e-government policies are subject of numerous indicator models. They are dealing with the ex-ante and ex-post evaluations of e-government policies on the basis of parameters, such as profitability, risks, benefits to external users, benefits to civil servants, services and project necessity. Also, they identify and analyze costs of establishment, provision and maintenance of e-government services, as well as to provide an economic analysis and evaluation of their performance and impacts. AGIMO additionally developed Demand and Value Assessment procedures. In general, we could find these indicator models very exhaustive in terms of the large number of indicators; however, they rarely address the concept of public benefits comprehensively, while the vast amount of data needed for the applied indicators considerably complicates their transfer to other environments.

Planning and implementation of e-government policies require careful scrutiny of sourcing alternatives [77]. Kern et al at [78] further analyze specific aspects of external implementation of ICT projects and address indicators for more objective evaluation in the process of decision-making for outsourcing of ICT projects. Surveys in this area are mostly dealing with sourcing issues in private sector firms, clearly they are predominantly focused on costs and other financial aspects, while organizational and human resources aspects are addressed to a smaller extent. Consequently, results of these surveys are hard to utilize in public sector organizations.

Implementation of e-government policies significantly affects public sector organizations in terms of changes in organizational structure, business processes and organizational culture at organizational and inter-organizational level [19]. There are previous studies focusing on one or more organizational dimensions, analyzing joined-up e-government model, exploring organizational changes in the direction of network government,

analyzing management, organizational culture and external factors which affect e-government development, studying business process change, information management capacity and organizational capabilities, while other highlight organizational culture aspect as well. Overview of the related studies reveals there is no clear consensus on organizational changes caused by the e-government implementation, and consequently no comprehensible method to measure these changes [65].

2.6 Evaluation aspects

One of the most important factors during the evaluation of E-Government policies and projects are the evaluating aspects that are taken into account. The existing indicator models for the evaluation of e-government policies are encompassing predominantly one aspect of the evaluation or focusing only on the evaluation of particular level within e-government policy. Up to date studies as well as available basic and applied research of e-government area facilitate extraction and synthesis of the key evaluation aspects and evaluation levels covered by the existing indicator models.

Analysis of the existing indicator models enabled identification of several different evaluation aspects. Although they tend to be partial and insufficiently defined, the evaluation aspects can be distinguished and roughly divided into four categories. Below are described accredited evaluation aspects and the research characteristics concerning each particular aspect [65]:

1. Evaluation of transformational effects: changes in back-office, the reduction of hierarchical levels, business process reengineering, outsourcing, reduction of administrative barriers, costs and burdens etc. (organizational aspect);
2. Evaluation of infrastructure investments: costs of ICT infrastructure, data infrastructure, human resources, legal framework (infrastructural aspect);
3. Evaluation of political and sociological effects: transparency, openness, corruption, user satisfaction, democratization, participation (political-sociological aspect);
4. Evaluation of economic and sustainability impacts: costs, public benefits, effects on GDP, competitiveness index, economic growth, sustainable development (economic and sustainability aspect).

2.7 Evaluation levels

Next to the categorization of the indicator models rendering four different evaluation aspects, indicator models can be classified according to the evaluation levels as well. During the research of the existing indicator models, five evaluation levels have been extracted and outlined: territorial-administrative unit level, sector policy level, program level, organization level and project level. Each of the specified evaluation levels can be evaluated using indicators from the different evaluation aspects presented above; also, some indicators contained within evaluation aspects may be used for the evaluation of one or more designated levels:

1. Territorial-administrative unit level of the evaluation refers to the territorial / administrative level being observed (e.g. particular level within the country; region, federal state, particular level between countries; cross-border regions and series of countries or country members of transnational organizations such as EU, OECD and UN).
2. Sector policy level of the evaluation encompasses various policies which are the subject of the evaluation (e.g. tax policy, environmental policy, research policy etc.).

3. Program level of the evaluation focuses on programs which usually present groups of program-related projects (e.g. e-health and e-learning program).
4. Organization level refers to the different levels of organizations (e.g. the level of state agency, ministry or its organizational unit/s, the level of municipality or any other public administration body).
5. Project level of the evaluation covers indicator models focused on projects, and services resulting from the projects (e.g. informatization of the process/service for establishment of a business).

Numerous difficulties were encountered trying to delineate the above itemized evaluation levels covered by particular indicator model, since the contained indicators are not clearly defined, enabling their speculative use on different evaluation levels. Comprehensive evaluation of e-government policies requires taking into account the complex structure of e-government and the intricacy of policy process itself. Proposed conceptual model for the evaluation of e-government policies attempts to capture a wide range of relevant factors, which is reflected in broadly defined aspects of evaluation (economic and sustainability, political-sociological, infrastructural and organizational), while it should also allow the evaluation of e-government policies at different levels (territorial-administrative unit, sector policy, program, organization, project). The conceptual model should lay the theoretical and practical foundations for later development of an integrated indicator model including the relevant and well defined indicators in depicted categories (evaluation aspects and levels). The conceptual model for the evaluation of e-government policies is presented in Figure 1 [65].

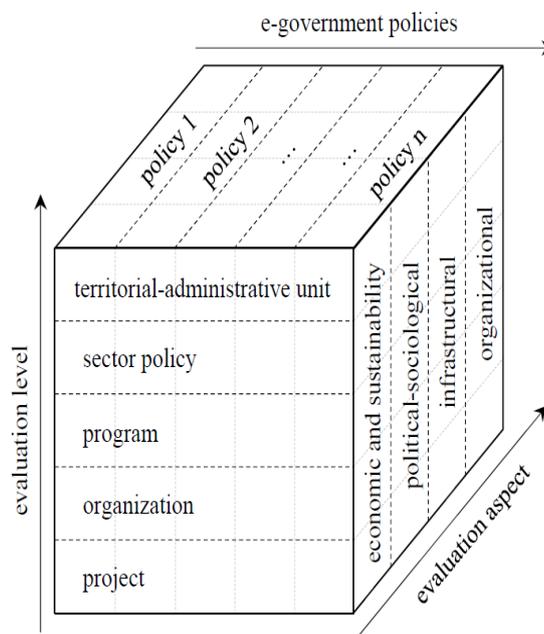


Figure 4: Evaluation levels and aspects of a conceptual model

3. INDICATOR MODELS

3.1 Review of indicator models

Research through existing literature, like papers at scientific journals, reports of international organizations and institutions, books, policy papers, development strategies and other related documents containing E-Government related topics, reveals that there are more than 50 relevant indicators. They are mainly focusing on measurement, assessment and evaluation of E-Government policies and their effects. During the second half of the decade of 2000 the frequency of references increased, underlying that this scientific field is getting more and more interesting for researchers and various other stakeholders.

Some of these indicators are considered very accurate and important for the theoretical background of further research and are widely used, while at the same time some frameworks were used once and later were abandoned. The most prominent one are West's framework, MAREVA, AGIMO, United Nations' framework, eGEP, WiBE, WEF, European Commission's, Accenture, Deloitte, Capgemini and many more.

There is a non-exhaustive list of models given later in order to underline the amount of available evaluation frameworks in academic research literature.

There are certain basic characteristics that can be identified through comprehensive analysis of the existing indicator models. They are presented below forming 8 arguments:

1. The majority of existing indicator models presents only a conceptual framework for the evaluation of e-government policies, while only a small number of them have been used in practical applications.
2. As a consequence of the previous, these indicators are outcome of scientific research and not practical experience.
3. Only a small number of indicator models appears in handbooks, some of which include a software or calculating tool for evaluation of e-government policies, for example WiBe 4.0 or VAST.
4. Some indicator models are rather abstract containing selected indicators and underlining theoretical frameworks without practical experience, while their utilization does not facilitate having quantifiable evaluation results.
5. Indicator models are usually narrowly focused mainly assessing one or two features of E-Government policies.
6. Mature indicator models that have been used more than one time are consisted of a large number of indicators normally created and tuned for the evaluation of E-Government policies in the originating countries. The most prominent indicator models, such as MAREVA, WiBe 4.0 and AGIMO, which have been most extensively used in everyday evaluation practice, are based on national characteristics of the administrative system and include material, procedural, legislative and other specifics of the public sector from which they originate. They are extremely detailed and extensive, containing a large number of indicators, which are specifically tailored for the evaluation of adequately documented e-government policies.
7. Indicator models generally do not provide a comprehensive evaluation of complex E-Government policies impacts and their potential long-term public benefits.

8. Some indicators and categories of them appear in dozens of indicator models, presenting a certain degree of overlapping. Definitions of indicators are different, and so evaluations are based on distinctive methodological platforms, making results comparisons a challenging procedure.

According to their application they can be classified in 3 main categories. Indicators can have these types of application [65]:

- Practical
It means that these indicators have already used to evaluate an E-Government project or policy. Concrete results of at least one study are available to the academic community and can be used for further research.
- Pilot
These indicators are developed up to a degree of pilot application and have been used with fictional data. However, they have not been used in real evaluations and are used as basis for advanced research purposes.
- Conceptual
Indicators created only in theoretical academic papers with the intention to create an evaluation framework that will be used in practice. These have not been used before and there are no pilot applications to prove their effectiveness.

A non-exhaustive list of these is given at the table below:

Table 7: List of evaluation models and their application level [65]

Ser. Num.	Author(s) – Year	Application level
1.	ADAE. Electronic Administration Development Agency (2007)	Practical application
2.	Rothig, P. (2010)	
3.	AGIMO. Australian Government Information Office (2004)	
4.	OECD. Directorate for science, technology and industry (2005)	
5.	Baudu, S. and Dzhumaliev, S. (2010)	
6.	RSO SpA & LUISS Management (2006)	
7.	WEF. World Economic Forum (2010/2011)	
8.	UN. United Nations (2008/2010/2012)	
9.	Rama Rao, T.P., Venkata Rao, V., Bhatnagar, S.C. and Satyanarayana, S.J. (2004)	
10.	Holzer, M. and Kim, S.T. (2007)	
11.	Economist Intelligence Unit (2010)	
12.	West, D. (2008)	
13.	European Commission, Capgemini, & IDC (2011)	
14.	Capgemini, IDC, Rand Europe, Sogeti and DTi (2011)	
15.	Accenture (2009)	
16.	Deloitte & Ipsos Belgium (2011)	
17.	UNESCO (2005)	
18.	Mahalik, D. (2010)	
19.	Capgemini (2007)	
20.	Empirica (2009)	
21.	Weehuizen, R. and van Oranje, C. (2007)	
22.	Jensen, P.H. (2007)	Conceptual framework
23.	Lacity, M. and Willcocks, L. (2009)	
24.	Greaver, M.F. (1999)	
25.	Kern, T., Willcocks, L.P. and van Heck, E. (2002)	
26.	Devadoss, P.R., Pan, S.L. and Huang, J.C. (2002)	
27.	Ho, A.T.K. (2002)	
28.	Moon, M.J. (2002)	
29.	Chen, Y.C. and Perry, J. (2003)	
30.	O'Donnell, O., Boyle, R. and Timonen, V. (2003)	
31.	Griffin, D., Foster, A. and Halpin, E. (2004)	
32.	Schedler, K. and Schmidt, B. (2004)	
33.	Leitner, C. and Kreuzeder, M. (2005)	
34.	Scholl, H.J. (2006)	
35.	Elnaghi, M., Alshawi, S. and Missi, F. (2007)	
36.	Indihar Štemberger, M. and Jaklič, J. (2007)	
37.	Klievink, B. and Janssen, M. (2009)	
38.	Pollitt, C. (2010)	
39.	CIO Council (2002)	
40.	Republic of Korea, Ministry of Public Administration and Security (2010)	
41.	OECD. Working Group 2 on E-government and Administrative Simplification (2007)	
42.	Martin, B. and Byrne, J. (2003)	
43.	van Veenstra, A.F., Janssen, M. and Tan, Y.H. (2010)	
44.	Boyer-Wright, K.M. and Kottemann, J.E. (2009)	
45.	Picci, L. (2006)	
46.	Singh, H., Das, A. and Joseph, D. (2007)	
47.	Rhee, D.Y. (2009)	
48.	Schwester, R.W. (2010)	
49.	Serrano-Cinca, C., Rueda-Tomás, M. and Portillo-Tarragona, P. (2009)	
50.	Bavec, C. and Vintar, M. (2007)	
51.	Gallego-Álvarez, I., Rodríguez-Domínguez, L. and García-Sánchez, I.M. (2010)	

Furthermore, an overview of the related studies reveals there is no clear consensus on organizational changes caused by the e-government implementation, and consequently no comprehensive method to measure these changes.

Moreover, a detailed review of these approaches reveals that they are focused mostly on individual area or aspect of e-government. First of all, the examine dealing with customers (front-office) and so evaluating the supply-side of e-government. A bit less for the demand-side, while largely neglecting the back-office and the impact and effects of e-government. This proves the opening supposition that current approaches do not support a comprehensive e-government assessment, but only partial evaluations that cannot give policy makers evaluation elements for their decisions, especially not in the direction of transformative government, characterized by integrated services development, where quality highly depends on back- office systems [50].

Table 8: Overview of approaches to evaluation of E-Government development [50]

Study by:	Area (M = main, S = supplementary)					Effects/ impacts	Countries/geographical region
	E-readiness		Back- office	Front-office			
	Government	Citizens & businesses		Supply	Demand		
Accenture [6]				M			world-22
Burgess and Houghton [66]				M			Aus
Booz Allen Hamilton [9]	M	M		S		M	G7 countries, Aus, Swe
Bartelsman Foundation – BEGIX [7]	M			M			UK, Ca, US, NZ, Est, Swe, Ger
BISER [8]		M				M	EU-15
The Henley Centre and MORI [72]	M	M				M	UK
Cullen and Houghton [63]				M		M	NZ
CapGemini Ernst & Young [13]				M			EU-15, N, Icl, Sui
PLS Ramboll and Eworx [61]						M	S
Erin Research Inc. [26]						M	EU-15
EuroBarometer [25,33]		M				S	Can
Vintar et al. [50]	M		M	M			S
Vintar et al. [48], Leben et al. [2]			S	M			SI
				M			SI, F, It, Sp, UK, Irl, A, Ger, Ca, Sin, HK, Aus
Gant and Gant [36]				M			US
Hart-Teeter [31]	S	S				M	US
TietoEnator Trigon [73]				M			EU-15, Ca, US, Aus, Sin
Kaylor et al. [11]				M			US
KEeLAN [41]				M			EU-15
Muylle et al. [68]						M	B, NL, UK, F
Momentum [53]		M				M	S
Canavate and Navarro [4]				M			ZDA
NACO [54]	M		S	S			Sp
NAO [55]	S	S		M			US
NOIE [57]				M			UK, Aus, US, Ger
NOIE and DMR [56]	S	S		M		M	Aus
Nordic Council of Ministers [58]	M		M	M			M
Dutta et al. [67]	M	M					S
Birch [16]	M		S				M
PTI and ICMA [62]	M			M			S
REGIONAL-IST [65]	M	M	S	M		S	M
Strover and Straubhaar [69]		M				M	Sp, Ger, It, Por, Hun
SIBIS [70]		M				M	Texas
Smith [3]							EU, US, Sui
SOCTIM [71]				M			NZ
Stowers [27]				M			UK
Dexter and Parr [1]		S				M	US
UN [74]		M		M			world-32
COMNET-IT [15]	M	S		M			world-191
Demchak et al. [12]				M			world-86
West (a) [18], (b) [19], (c) [17]				M			world-102
							(a) US, (b) US, (c) world-198

3.2 General differences

Examining in depth existing evaluation indicator models leads to the conclusion that they have many and distinct differences. These differences among them arise from diverse reasons:

- different organizers (such a supranational organization like the European Union, an international organization like the United Nations, a well-known university as the Brown University, a scientific unit of a popular economics magazine such as the Economist Intelligence Unit and national governments.
- heterogeneous promoters which can be international organizations, national stakeholders, consulting companies to investors, other companies and governments, research institutions with academic intentions, all of them with distinct interests and purposes for the operation and use of the results.
- diverse environments in which evaluations and benchmarking has to take place and results to be analyzed. In a different social and political environment, there are different priorities when measuring and evaluating and distinctive rendering of each indicator result.
- various rationales and contextual background used in frameworks in order to serve better their intentions, creating an effective and efficient evaluation model.
- the number (e.g. AGIMO contains approximately 150 indicators and eGEP contains 92 indicators) and selection of indicators. These are selected depending on the needs and the purposes of each evaluation framework aiming to have the most complete and wide evaluation possible.
- significant differences between indicator models are also reflected within their main evaluation aspects and evaluation levels, as analyzed before, since each rationale has a distinct approach to the evaluated and a different translation of the evaluation environment.

As presented graphically by Savoldelli et al. at [53]:

Table 9: Difference among evaluation models at [53]

	<i>Mareva</i>	<i>WiBe 4.0</i>	<i>eGEP</i>	<i>NOIE</i>	<i>GOL</i>	<i>VMM</i>	<i>DVAM</i>	<i>Gateway Process</i>
<i>Policy plan evaluation</i>					X		X	
<i>Project and/or Services ex Ante Evaluation</i>	X	X	X	X	X	X		X
<i>ex Post Evaluation</i>			X	X	X	X		X
<i>Business case template</i>	X				X	X		X
<i>Risk assessment</i>	X				X	X	X	X
<i>Sustainability Assessment</i>	X	X		X	X	X	X	X
<i>Effectiveness</i>		X	X	X	X		X	
<i>Efficiency/Productivity</i>	X	X	X			X		X
<i>Organizational efficiency</i>	X	X	X		X			X
<i>User centricity</i>		X	X		X	X		X
<i>Services integration</i>	X	X	X		X		X	X
<i>Strategic alignment</i>		X				X		X
<i>Privacy and security</i>	X	X			X	X		

<i>Social Value</i>	X	X	X	X
<i>Democracy</i>	X	X		X

3.3 Categories of frameworks

As a result of the previous analysis on existing benchmark indicators, evaluation frameworks can be further categorized according to the type of their outcome, the reason of the evaluation and its value.

The first and most important category is the one measuring E-Government Service Quality and users' satisfaction. It assesses the quality of provided services and measures how satisfied users are when using it.

This is mainly measured through the evaluation of "front-office" services and is very common in practice worldwide. The most prominent frameworks are West's framework, Accenture's and United Nations' E-Government Development Index. Websites of public authorities and state services are being evaluated under certain requirements regarding Service Delivery Quality and Service Content.

- Service Delivery Quality refers to what a user can see when interacting with an E-Government website. Mainly to the Accessibility options of the website, its Security provisions, the selected Design and the User's Experience, as well as the total Ease of Use. All these aspects are being evaluated under certain criteria created by World Wide Web Consortium (W3C) – mostly referred as W3C Accessibility Standards, Jakob Nielsen - known as Nielsen's usability principles - and other researchers on usability of websites and digital applications.
- Service Content points out what a user can do when using an E-Government application. It indicates Functions provided and regularity of Updates to them. They are accounted as the application has to be maintained useful and efficient. As a result, overall Effectiveness and the amount of Time consumed when using the website are being credited to form the final assessment of the E-Government application under evaluation.

Acceptance by users is also an important attribute. It contributes to a much more precise and close to complete evaluation of an E-Government policy or application. The amount and percentage of users who actively use and support the website is determining for the present and future of each Information and Communication Technology that is changing and evolving through years. Using again an application usually, but not always, indicates positive opinion on it and provides useful feedback for further improvement.

The second category is the one with frameworks intending to assess Public Value and the Development side of E-Government applications. Digital Government, as analyzed earlier in this paper, is supposed to be an important factor of economic growth and development and so this has also to be accounted in an evaluation attempt. Very well-known models like eGovernment Economics Project (eGEP 1 – containing 92 diverse indicators - and 2.0) and MAREVA serve this benchmarking approach. The main purpose of eGEP is to identify and analyze costs of establishment, provision and maintenance of E-Government services, as well as to provide an economic analysis and evaluation of their performance and impacts.

A third category of frameworks intends to assess economic efficiency and at the same time user satisfaction. Economic efficiency is an important component of any state project paid by taxpayers' money. Evaluation models, with WiBe 4 being the most popular and used, attempt to assess how economically efficient an E-Government

project or policy is and at the same time how satisfied users are by it. Creating a ratio of efficiency and users' satisfaction seems an interesting basis for further research.

Demand and value are ideas that have not been thoroughly assessed until now at the academic field of E-Government benchmarking. As analyzed before, they are supposed to be very important when examining how successful an attempt is, however are presumed to be rather complex to evaluate. AGIMO created by Australian Government Information office in 2004 focuses on evaluating demand for E-Government services and their overall value as well. It contains approximately 150 distinct indicators.

A more inclusive evaluation and benchmarking framework is the one that United Nations use in their global E-Government report. For many researchers it is supposed to be less subjective and more complete as it has countless indicators in various levels of technological, political and social development regarding digital government. I was first introduced by United Nations Division for Public Economics and Public Administration (now United Nations Division for Public Administration and Development) in 2002 and has been used many times since then.

Another category of evaluation and benchmarking models are the ones for general development and Information Technology Society indexes. ITU's ICT Development Index is one of them evaluating the development and adoption of Information and Communication Technologies in every part of the world. It is not a specified model for E-Government policies and services, but is an important indicator for a prerequisite for any digital government attempt, new technologies and adoption of them.

One side of E-Government effect on modern administration is administrative efficiency. Information systems come to improve efficiency of processes wherever used and so they do when used to serve in public services. Their efficiency when used and the improvement they offer in public services has to be measured according to principles used for any information systems strategy, but bearing in mind the uniqueness of services created to offer public value. A stochastic frontier model has been used in [75] by Pang et al. to estimate the advantages brought by E-Government implementation in the United States Governments.

3.4 Most important frameworks

Having studied existing academic literature, three of current frameworks were chosen to be analyzed in various levels and be compared up to the degree that they can be compared. West's framework, eGEP and United Nations' framework. The reasons for this choice are multifaceted.

First of all, these are the most used frameworks in practice. They have been used to evaluate and benchmark E-Government policies and projects many times after the first years of 2000 decade. Their recurring application underlines that they are successful and effective. They have thoroughly studied by various researchers for their capabilities, advantages and drawbacks. They are also tuned and improved through practical experience gained during employment. Theoretical knowledge is added as well since they are widely studied.

Moreover, the presented frameworks are widely accepted. They are considered to be accurate and so quite reliable. Their methodology is well justified and open to the public. Their results are widely used in order to indicate progress of E-Government in various countries. Diverse stakeholders use them when mentioning policies and arguments regarding E-Government, making them representatives of E-Government concept in

discussions and reports outside academic environment. Politicians, investors and many other use the results of these frameworks to support their decisions and ideas.

Furthermore, they can be used and as a basis for further research and fruitful criticism, which has already happened as can be seen in existing literature. Academic papers presenting, analyzing, commenting and restructuring them have been cited many times in new research efforts. They have been made the scientific standards for their field and have influenced deeply the scientific community in many ways.

As a result, the following three frameworks are presented in order to introduce their scientific methodology. Their different approaches to the same issue underlines the already analyzed complexity of E-Government policies and the varied points of views of different authors. Each framework has a different intention and scope and so is differentiated from the others.

The most important frameworks are the following:

- **West's framework**

West's framework was the one setting an important milestone in E-Government evaluation back in 2004. Its methodology presented below was widely adopted by other researchers and used for the creation of many more variations and tuned versions. It is probably the most cited evaluation framework within academic community and has highly influenced researchers' view towards E-Government and evaluation efforts.

Regarding scientific evaluation methodology, West's E-Government index does not account for stages of E-Government development. Although the Web Measure Index does reflect the level of sophistication of a UN Member State's online presence [48], it uses a five stage model (emerging, enhanced, interactive, transactional, and seamless/networked) of development, as analyzed before.

West's method of computing an E-Government index follows a two-step process. First, a value (between 0 and 100) is computed for each website sponsored by a country. These individual website E-Government index values are then averaged to compute a single index for the country. Equations (1) and (2) encapsulate West's procedures at [72]:

E-Government index for website i:

$$e_i = 4 f_i + x_i \quad (1)$$

where,

f_i = The number of features present on website i, $0 \leq f_i \leq 18$

x_i = The number of online executable services on website i, $0 \leq x_i \leq 28$

And so,

E-Government index for country j:

$$E_j = \frac{\sum_{i=1}^n e_i}{n} \quad (2)$$

Where,

e_i = E-Government index for website i (computed using Equation (1)), $0 \leq e_i \leq 100$

n = Total number of website for country j , $n \geq 1$.

On the positive side, West's E-Government index is based on objective measures and is quite straightforward. On the other hand, West's approach has a number of limitations:

- Uneven Multiplication: By choosing to multiply f_i by four while not doing so to x_i , West significantly values website features over online executable services. Given that websites with more executable services are likely to provide higher levels of E-Government service than those with only simple features, weighting features over services appears inappropriate.
- Feature Limits: With f_i set at a maximum value of 18, Equation (1) cannot account for a website with more than 18 features.
- Service Limits: With x_i set at a maximum value of 28, Equation (1) cannot account for a website with more than 28 online executable e-Government services.
- Quality or Functionality Ignored: No weight is given to the quality or functionality of the E-Government service websites. Each website is afforded the same weight in the indices whether it is a static page with very little information or a fully-fledged portal [54].

- **eGEP 1 and 2.0**

The eGEP 1 framework, elaborated for the European Commission, despite presenting some limitations, has been largely recognized that it provides a more robust approach in assessing outcomes of E-Government initiatives [65]. It represents one of the most comprehensive approach available but suffers from the lack of the dynamic element needed to capture the processes that in each public agency move from initial planning, through implementation, up to monitoring and evaluating results.

The eGEP 2.0 framework is considered rigorously only an E-Government measurement framework not evaluating the effect that a given service or bundle of services (i.e. E-Government application or policy) have for different constituency on a given sought outcome. This, however, does not necessarily mean that a measurement framework such as eGEP 2.0, cannot be linked to, and support, impact evaluation, through for instance adding a counterfactual evaluation. In fact, if the measurement is built on scientifically sound and empirically robust model of causal impact and if data are gathered on the objects of measurement steadily and reliably then eventually that can be used for a true impact evaluation. It has been built starting from the eGEP framework, which has been improved in various aspects, especially in the participation mechanisms for involving stakeholders and beneficiaries in the measurement process of e-Government services. the proposed measurement framework aims at overcoming the previous approaches. It aims at overcoming the previous approaches, helping to establish a trust-based relationship among citizens, policy makers, civil servants and other stakeholders, so to balance the precision in the measurement of the impacts of e-

Government projects, with a more transparent and participatory assessment process since the early stage of the policy-making cycle.

eGEP is structured into three levels:

- overall goal (level 0)
- outcomes criteria (Level 1)
- impact indicators (Level 2)

It has been applied for benchmarking the performances of e-Government web portals across administrations belonging to different EU Member States, therefore its nature mainly descriptive was successfully used in ex-post assessment of e-Government initiatives [64]. However, eGEP as it was designed cannot be used to model a policy-making process because it does not allow to represent the policy strategy formulation process, from the definition of the overall goals of a given policy planning cycle, to the definition and approval of policy guidelines. Moreover, it does not provide the necessary decisional links between the policy strategy dimension and the implementation of projects and it does not have the ability to model the circular nature of the policy-making process.

In general terms, in fact, expected policy outcomes shape expected policy impacts (usually called policy guidelines). For achieving these guidelines, public administrations implement projects which start their lifecycle as project's ideas, by defining projects' expected outcomes, also called needs. Upon these needs, an ex-ante estimation of the degree of achievement of quantifiable objectives is provided before deciding the projects' portfolio suitable for implementing a given policy plan. These objectives are usually called expected impacts and are used for justifying project's expected outputs. Vice versa the degree of achievement of given projects' outputs, allows estimating projects' impacts and to determine to what extent projects have satisfied the need for which they have been implemented.

The main differences between them are presented at the table below:

Table 10: Differences between eGEP 1 and 2.0

Comparison criteria	eGEP-2.0	eGEP
Degree of flexibility in policy planning process assessment	High	Low
Degree of flexibility in e-Government projects measurement	High	Medium
Degree of flexibility in participative measurement through stakeholders and citizens involvement	High	Low
Types of impact assessment stages supported	<i>ex-ante – interim – ex-post</i>	mainly <i>ex-post</i>

- Degree of flexibility in policy planning assessment. The majority of the E-Government measurement frameworks, including eGEP, are static by nature, based upon predefined criteria that are mainly related to projects that they are going to measure or compare, but rarely are designed to measure the link

between policy objectives and E-Government projects as eGEP-2.0 tries to achieve.

- Degree of flexibility in E-Government project measurement. The eGEP model, as other models analyzed is based upon a static hierarchy constituted by a fixed number of measurement criteria and indicators that do not allow addressing all the characteristics of an e-Government policy plan and its related implementation projects. eGEP-2.0 model instead is structured with a dynamic hierarchy, that could be adapted to any E-Government policy plan.
- Degree of flexibility in participative measurement through stakeholders and citizens' involvement. The eGEP model, as all others, does not allow an effective participation of stakeholders and beneficiaries in the policy-making process. eGEP-2.0 instead provides the necessary support to involve all relevant stakeholders since the beginning of the policy-making process. Their involvement is foreseen in three stages (project definition and specification; weighting systems provisioning for hierarchical re-composition of evaluation criteria; weighting systems provisioning for hierarchical re-composition of policy guidelines) of the measurement process.
 - Defining E-Government projects to be evaluated/funded. In the figure this is represented by the steps placed in the lower-left side of the diagram. The involvement of stakeholders is foreseen through the fulfilment of a web-based project's description template, which allows to reach a consensus among various policy actors on key dimensions constituting the project's characteristics.
 - Choosing indicators suitable for measurement projects in coherence with the policy guidelines (left side of the flow-diagram). This is guided by a feasibility-check procedure that allows verifying the compliancy of project's objectives with policy guidelines.
 - Defining weighting system needed for hierarchical re-composition of the impact assessment model and the quantification of the e-Government adoption index. This is represented in the right side of the figure. In this case the key difference with eGEP re-composition approach consists in the adoption of weighting systems based upon stakeholders' preferences and the adoption of a negotiation process amongst policy actors based upon a sensitivity analysis of the weight assigned to the various levels of the hierarchical model.
- Types of impact assessment stages supported. As the majority of the frameworks analyzed, also eGEP has been designed to support mainly ex-post assessment. Its applicability to other evaluation stages, even if it could be possible in theory, in practical terms is difficult, especially with regard to the estimation of ex-ante expected impacts, because it does not have enough flexibility neither in modelling the policy plan, nor in supporting participative measurement of the related implementation projects.

eGEP-2.0 measurement model. Logic flow of measurement and their relationships with policy actors in different policy-making stages at the figure below:

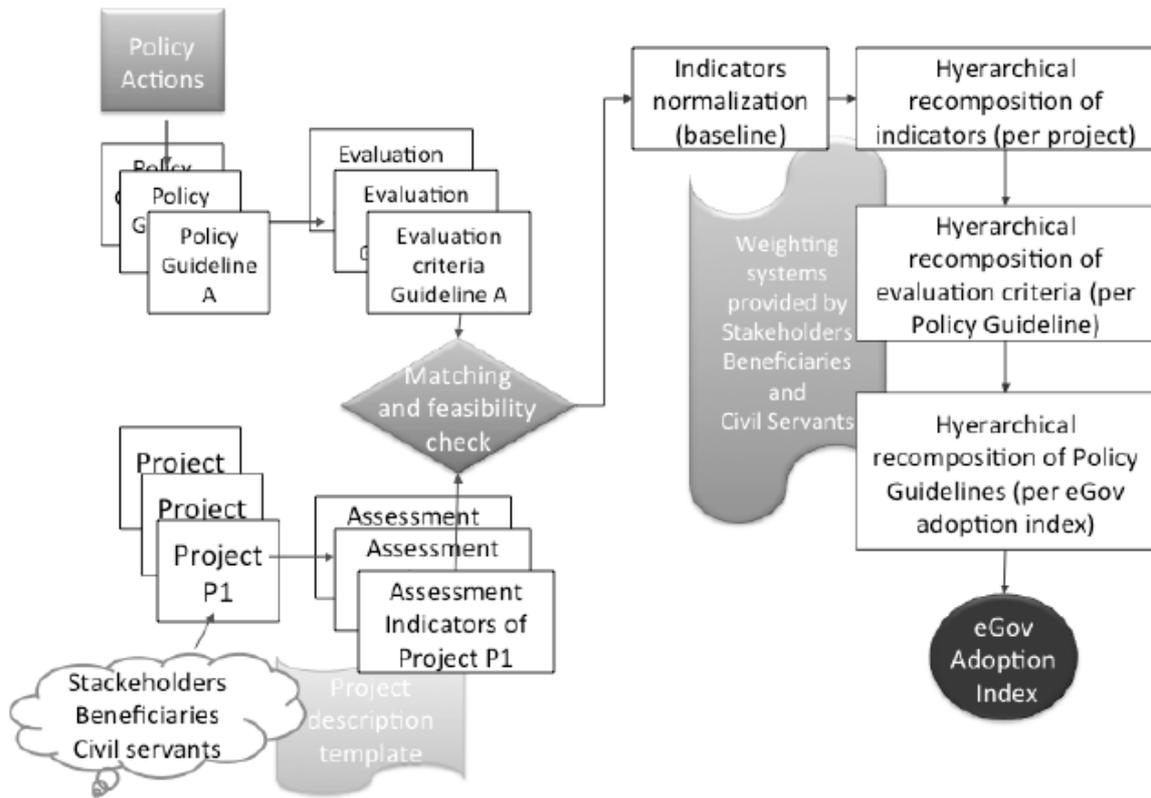


Figure 5: Logic flow of measurement of eGEP

The application of the eGEP 2.0 framework is described by the following figure:

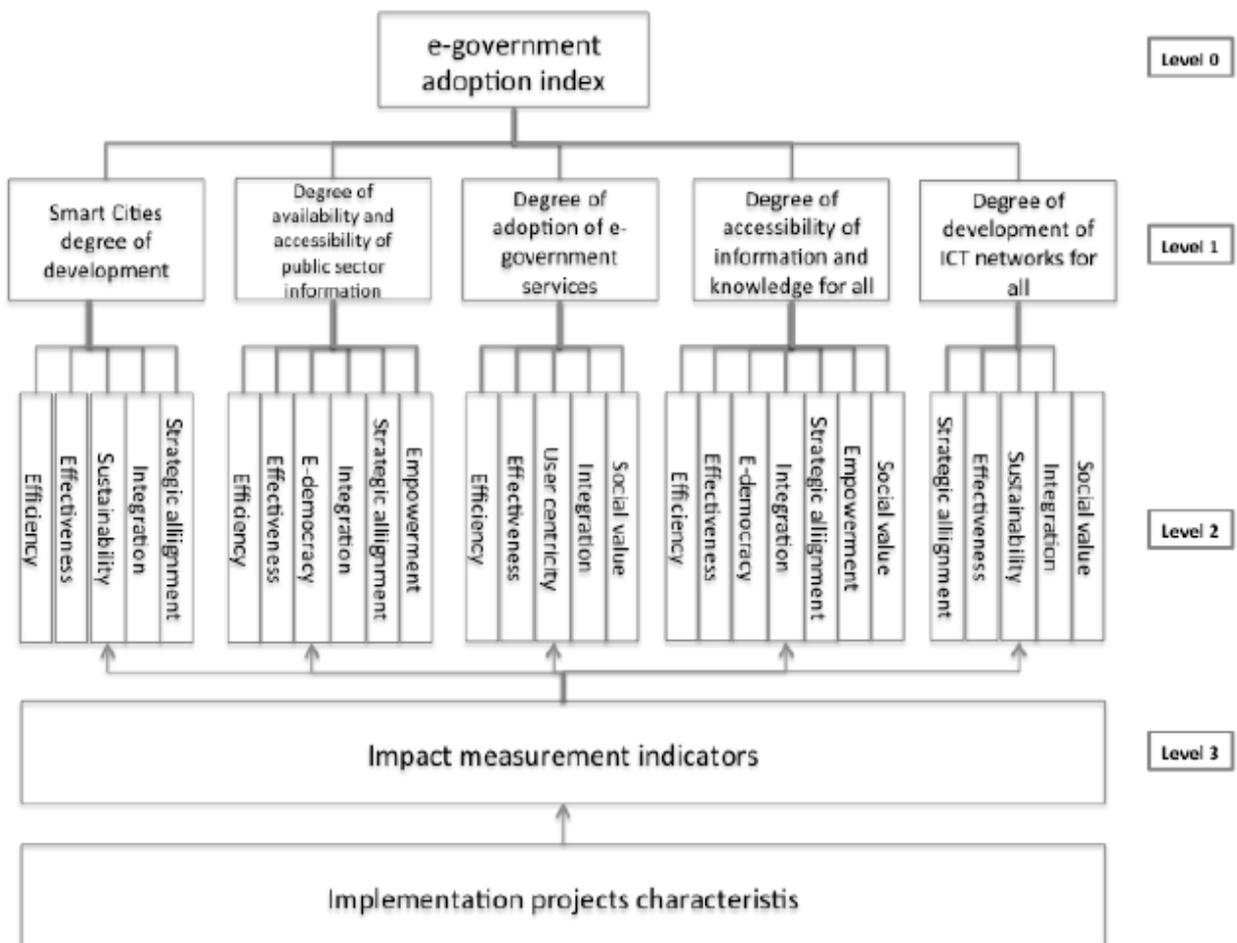


Figure 6: eGEP 2.0 application description

- **United Nations E-Government Survey**

As a composite indicator, the E-Government development index (EGDI) is used to measure the willingness and capacity of national administrations to use information and communication technologies to deliver public services.

The EGDI is based on an expert assessment survey of the online presence of all 193 United Nations Member States, which assesses national websites and how E-Government policies and strategies are applied in general and in specific sectors for delivery of essential services. The assessment rates the e-government performance of countries relative to one another as opposed to being an absolute measurement. The results are tabulated and combined with a set of indicators gauging a country’s capacity to participate in the information society, without which e-government development efforts are of limited immediate use.

Although the basic model has remained consistent, the precise meaning of these values varies from one edition of the Survey to the next as understanding of the potential of e-government changes and the underlying technology evolves. This is an important distinction because it also implies that it is a comparative framework that seeks to encompass various approaches that may evolve over time instead of advocating a linear path with an absolute goal.

Mathematically, the EGDI is a weighted average of three normalized scores on three most important dimensions of e-government, namely:

- scope and quality of online services (Online Service Index, OSI)
- development status of telecommunication infrastructure (Telecommunication Infrastructure Index, TII)
- inherent human capital (Human Capital Index, HCI).

Each of these sets of indices is in itself a composite measure that can be extracted and analyzed independently.

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

Prior to the normalization of the three component indicators, the Z-score standardization procedure is implemented for each component indicator to ensure that the overall EGDI is equally decided by the three component indexes, i.e. each component index presents comparable variance subsequent to the Z-score standardization. In the absence of the Z-score standardization treatment, the EGDI would mainly depend on the component index with the greatest dispersion. After the Z-score standardization, the arithmetic average sum becomes a good statistical indicator, where “equal weights” truly means “equal importance.”

For standard Z-score calculation of each component indicator:

$$x_{new} = \frac{x - \mu}{\sigma}$$

where:

x is a raw score to be standardized;

μ is the mean of the population;

σ is the standard deviation of the population.

The composite value of each component index is then normalized to fall between the range of 0 to 1 and the overall EGDI is derived by taking the arithmetic average of the three component indexes.

As indicated, the EGDI is used as a benchmark to provide a numerical ranking of e-government development across United Nations Member States, yet this approach has its own weaknesses.

The methodological framework for the United Nations E-Government Development Index has remained consistent across the Survey editions. At the same time, the Survey has been adjusted to reflect emerging trends of e-government strategies, evolving knowledge of best practices in e-government, changes in technology and other factors, and data collection practices have been periodically refined.

Given the availability of suitable data by the International Telecommunication Union, a new wireless broadband subscription indicator was included in the computation of Telecommunication Infrastructure Index (TII) in the 2014 Survey. The TII is an arithmetic average composite of five indicators:

- estimated internet users per 100 inhabitants
- number of main fixed telephone lines per 100 inhabitants
- number of mobile subscribers per 100 inhabitants
- number of wireless broadband subscriptions per 100 inhabitants
- number of fixed broadband subscriptions per 100 inhabitants.

Each of these indicators was standardized via the Z-score procedure to derive the Z-score for each component indicator. The telecommunication infrastructure composite value for country “x” is the simple arithmetic mean of the five standardized indicators derived this way:

Telecommunication infrastructure composite value

$$\begin{aligned} &= \text{Arithmetic Mean} (\text{Internet user Z score} + \text{Telephone line Z score} \\ &+ \text{Mobile subscription Z score} \\ &+ \text{Wireless broadband subscription Z score} \\ &+ \text{Fixed broadband Z score}) \end{aligned}$$

Finally, the TII composite value is normalized by taking its value for a given country, subtracting the lowest composite value in the Survey and dividing by the range of composite values for all countries.

The Human Capital Index (HCI) contains four indicators:

- Adult literacy is measured as the percentage of people aged 15 years and above who can, with understanding, both read and write a short simple statement on their everyday life.
- Gross enrolment ratio is measured as the combined primary, secondary and tertiary gross enrolment ratio, of the total number of students enrolled at the primary, secondary and tertiary level, regardless of age, as a percentage of the population of school age for that level.
- Expected years of schooling is the total number of years of schooling which a child of a certain age can expect to receive in the future, assuming that the probability of his or her being in school at any particular age is equal to the current enrolment ratio age.
- Mean years of schooling (MYS) provides the average number of years of education completed by a country’s adult population (25 years and older), excluding the years spent repeating grades.

The HCI is a weighted average composite of the four indicators. Similar to calculating the TII, each of the four component indicators is first standardized via the Z-score procedure to derive the Z-score value for each component indicator. The human capital composite value for country “x” is the weighted arithmetic mean with one-third weight assigned to adult literacy rate and two-ninth weight assigned to the gross enrolment ratio, estimate years of schooling and mean years of schooling derived this way:

Human capital composite value

$$\begin{aligned} &= \frac{1}{3} \text{ Adult literacy rate Z score} \\ &+ \frac{2}{9} \text{ Gross enrolment ratio Z score} \\ &+ \frac{2}{9} \text{ Expected years of schooling Z score} \\ &+ \frac{2}{9} \text{ Mean years of schooling Z score} \end{aligned}$$

Then, the human capital composite value is normalized by taking its composite value for a given country, subtracting the lowest composite value in the Survey and dividing by the range of composite values for all countries.

To arrive at a set of Online Service Index values, more than 90 researchers - qualified graduate students and volunteers from universities in the field of public administration assessed each country's national website in the native language, including the national portal, e-services portal and e-participation portal, as well as the websites of the related ministries of education, labor, social services, health, finance and environment as applicable. To ensure consistency of assessments, all the researchers were provided with a rigorous training by E-Government and online service delivery experts, with years of experience in conducting the assessments. All the researchers were guided by a Data Team Coordinator who provided support and guidance throughout the assessment period. Researchers were instructed and trained to assume the mind-set of an average citizen user in assessing sites.

Thus, responses were generally based on whether the relevant features could be found and accessed easily, not whether they in fact exist although hidden somewhere on the sites. While it is possible, although implausible, to search the sites meticulously for all content and features, this approach misses the key point that the average user needs to find information and features quickly and intuitively for a site to be "usable" with content readily discoverable by the intended beneficiaries.

The Survey questionnaire is organized in specific thematic sets of questions (subthemes) structured in four patterns corresponding to the four stages of E-Government development. The patterns have been designed to provide a qualitative assessment within a rigorous quantitative methodology.

Each question calls for a binary response. Every positive answer generates a new "more in depth question" inside and across the patterns. For the 2014 Survey questionnaire, the thematic subthemes identified are:

- Whole-of-government
- Multichannel service delivery
- Bridging the digital divide
- Increasing usage
- Open Government
- E-participation

The outcome is an enhanced quantitative Survey with a wider range of point distributions reflecting differences in levels of e-government development among countries. The total number of points scored by each country is normalized to the range

of 0 to 1. The online index value for a given country is equal to the actual total score less the lowest total score divided by the range of total score values for all countries.

3.5 Comparison of most important frameworks

After having reviewed in depth the methodology, rationale and approach to the evaluated policy or project of the three most important evaluation and benchmarking frameworks, it is transpired that they can be compared up to a certain degree. Due to their general differences as analyzed before, an identical comparison taking into account every single point is not desired, as it would create several falsities.

This sectional comparison produces interesting results. They not only reveal the increasing academic potential that evaluation of E-Government has, as this scientific field has not matured yet, but also why benchmarking is so important for any digital government policy nowadays.

First of all, despite the almost identical purpose of these evaluation frameworks, their approach to evaluated are distinct. Sometimes even measuring the exactly same element, such as transaction services provided for example, can be done in a very different way.

West supports that E-Government policies can be evaluated by the online presence that states have. The extent of options provided to users forms the total grade that a country receives, as for the author of the framework the most important is what experience a user can really get when using the provided services.

eGEP focuses on the clarity of goals, the effective definition of criteria for success and the adaptation of indicators to them in order to have a reliable evaluation. It is a different approach making stricter and wider yardsticks for what is contributing to the final result.

United Nations' E-Government Development Index concentrates on analyzing and taking into account all aspects of surrounding environment affecting and influencing E-Government policies and implementations. E-Government is not regarded as a simple phenomenon affected only by one or two variables. It is considered as an outcome of many distinct social, political and technological components and there is an effort to take into account as many as possible of them.

Moreover, due to the reasons mentioned before, methodologies used are dissimilar. Of course, quantitative characteristics are mostly used by all of them. However, it is clear that qualitative attributes need also to be included under specific circumstances.

West uses a mathematical formula with variables presenting countries' online presence and executable services quantity. He tries to create an index representing E-Government progress for each country that can be comparable to the one of others. His formula is not very complex creating various concerns regarding its representing capacity for a policy that is not considered to be simple.

eGEP analyzes thoroughly every single aspect of the evaluated E-Government application. It grades each part at each level and providing an overall assessment by calculations of the partial indicators. It is a very detailed procedure that aims to take into

account every possible aspect affecting the results of the evaluated policy. This is the reason why this framework is time-consuming when used, but also capable of calculating public value and users' overall satisfaction.

UN EGDI uses a mathematical formula taking equally into account three basic variables regarding various interest parts. These variables are calculated through other mathematical formulas with many more variables. Variables of the lowest levels are indicators of various services and other statistical facts. This procedure creates indexes for each country comparable to each other. Its methodology is considered to be simple but needs a rather sizable amount of data to process in order to create a final outcome. It is not very easy perform all calculations without having collected detailed information for each case.

Furthermore, one more remarkable difference is the qualitative characteristics of results provided by evaluations with each of these frameworks. Results provided by West's framework aim to identify and present the scientific and political interest of E-Government in each country. Technologies used and policies implemented are highlighted providing an overall scope of how E-Government has been implemented and for which reasons. It reveals an underlying interest for the impacts that E-Government policies have on each state government, but by measuring the services provided and not the real changes that have happened after the implementation of these E-Government services.

Evaluations and benchmarking of eGEP framework, on the other side, use their outcome to underline not only the success of a policy but also the overall public value created by E-Government applications. Their importance and influence in people's life as well as acceptance of users is emphasized at results. It is a human centered evaluation framework that does not aim to compare countries for their progress in E-Government investments and development. Its main intention is to identify the real repercussion of digital government policies in people's lives and governments' operations.

United Nations EGDI focuses on using results of E-Government policies as an indicator of general global progress in various levels, such as technological, economic and social progress in different parts of the world. It aims to present an overall status of the services provided by states to their people and to designate global trends, development differences, social and political cleavages on the way technology and government practices are perceived in various parts of the world.

On the basis of the preceding points, useful conclusions can be formed regarding the most noteworthy variations of the three most important E-Government evaluation and benchmarking frameworks. West's framework is more practical focusing on what really works, how it operates and up to which degree. Current affairs are important and have to be revealed.

At the same time, eGEP concentrates on what societies need and want from E-Government applications and how this can be achieved in order to serve citizens and other interested stakeholders. Every state investment is important and its outcome has to be described in detail up to the last of its points.

United Nations' E-Government Development Index describes the current situation of digital government and digital societies around the globe. It provides a more holistic approach of how E-Government operates and evolves through years. Its results are crucial to assess global technology and digital development, as well as to think about future challenges that are emerging.

4. CONCERNS, SUGGESTIONS AND FURTHER RESEARCH

4.1 Concerns regarding evaluation of E-Government

After having analyzed the most important aspects of E-Government policies and implementations evaluation and having presented the most used frameworks for such operation, there are many arguments regarding complications and issues of benchmarking and evaluating them.

The evaluation of e-government policies is generally difficult, as elaborated by Bannister in [61] and by Capgemini et al. at [79], given the frequent lack of clarity of objectives owing to the different and often competing views held by different stakeholders. Overlapping of E-Government initiatives and their continuous fine-tuning, in order to be adapted to specific needs and characteristics, further complicate monitoring and evaluation. The fact that E-Government is relatively new as a field of academic research is probably the main reason for fewer models and actual outcome experiences that can be used for benchmarking.

In addition, Information and Communication Technology projects are hard to evaluate because of the pervasive nature of ICTs, the integration of ICT goals with policy goals and the organizational changes that necessarily accompany E-Government initiatives [65]. All these aspects are hard to be clearly defined and measured, especially at a short term period.

Furthermore, main criticism of benchmarking based on web measures is based on the following arguments that reflect various researchers:

- It does not account for internal re-organization, national context and priorities, and the users' perspective, as all these are much harder to analyze and measure.
- It is not totally reliable as different benchmarks produce different ranks even for the same country. The methodologies used are not always revealed by individuals and organizations conducting the benchmarking, producing more concerns and questions on the originality of results.
- The stages of E-Government service development used in the computation of E-Government benchmarking indices often do not reflect actual E-Government service use and linear progression [64]. As mentioned before, E-Government progress and transition from stage to stage is not always proportional to the weight valued by benchmarking indicators.

Moreover, E-Government benchmarking methods become more problematic, and the critics' views more telling, when they move beyond objective, supply-side criteria (such as are services offered online via websites top citizens and businesses) to include calculated indices, psychometric measures, or other subjective indicators (some of them are a human development index and general internet use) [54]. These less objective

benchmarks cannot always have a scientific justification and a solid academic proof in order to be widely accepted.

This is the reason why a detailed review of evaluation approaches reveals that they are focused mostly on individual area or aspect of E-Government, first of all on dealing with customers (front-office), evaluating the supply-side of E-Government and something less demand-side, while largely neglecting the back-office and the impact and effects of E-Government. This proves the opening supposition that current approaches do not support a comprehensive and holistic E-Government assessment, but only partial evaluations. These cannot provide policy-makers evaluation elements for their decisions, especially not in the direction of transformative government, characterized by integrated services development, where quality highly depends on back-office systems. Citizens and other stakeholders can only have an impression of the aforementioned but not a complete image of the political, social and technological phenomenon that E-Government presents in our days.

4.2 Suggestions and remarks

E-Government is a new academic field that has been explored to only a small degree. As part of Computer Science there are many more to be discovered, researched, analyzed and presented in the future.

First of all, front-office services have to be evaluated under a common framework including all possible indicators. User experience is very important for modern web applications and has to be taken well in mind when evaluating the success of a government platform. The variety of offered services and their level of progress has also to be well studied.

Moreover, demand side has to be wider evaluated. What citizens and businesses need from the government has to be further analyzed. E-Government applications are created in order to offer digital services to citizens and businesses and as a logic consequence have to be adapted to their needs, serve their requirements and assist them with their obligations.

Furthermore, back office impact has not been analyzed up to a satisfactory degree until now. The use of information systems in order to organize, congregate, share, communicate and process data about various public issues, instead of books and huge libraries of archives is a modern revolution. This tremendous change at the basis and structure of state promotes several organizational and administrative changes that have to be studied thoroughly. There is not a common model for this category of evaluation but has to be created.

In addition, impacts and effects in various other categories, such as business administrative burden has to be studied. These side effects of using digital media in order to facilitate transactions and lower general costs is the epitome of using technology in service of people. There are thousands of examples where E-Government services are wisely use to make people's life easier and less expensive and it is critical for further evolution and spread of E-Government tools to identify them, study and reach conclusions by them.

4.3 Future research

The most challenging domain of E-Government evaluation and benchmarking for researchers and also policy makers is the concept of Government 2.0. It is a type of government that uses interactive communication technologies to transform connections between government and citizens into increasingly open, social and user-centered relations.

Government 2.0 - a more open, social, communicative, interactive and user-centered version of E-Government – has the potential to reshape the relationship between government and citizens, in a sense that services, control and policy formulation are designed through a cooperation of citizens, governments and civil society. These networks of cooperation hold an enormous potential to enhance the effectiveness and legitimacy of government and, therefore, Government 2.0 is presented as the appropriate reaction to changes in society. In practice, however, the use of the Government 2.0 potential is still limited.

The main channels of communication for Government 2.0 are the social media that have changed the way we communicate. They provide the needed platform for mass communication, congregation of thoughts and ideas and exchange of views at a broader level.

The literature review provided important insights in the difficulties of realizing Government 2.0 and transforming relations between government and citizens. More specifically, three main challenges have been identified:

- Creating new (collective) leadership roles that are fundamentally different from bureaucratic roles. This first set of factors relates to government itself. Government 2.0 requires a government that uses technology to improve relations with citizens.
- Making serious communication attractive to citizens who are increasingly motivated by game-type interactions and 'fun'. The second set of factors relates to citizens. Citizens need to be willing and able to connect to government: Government 2.0 without citizen participation is empty. Their incentives and their opinions and ideas have to be taken account and form decisions of the administration.
- Stimulating the exchange of identity information without forcing people to disclose more identity information than they feel comfortable. The third set of factors relates to the relation between government and citizens: technologies need to be used to develop trusting relations between government and citizens. Mutual trust is definitely needed in order to reach the maximum capacities that Government 2.0 can provide.

Evaluation and benchmarking of an even more improved and complex E-Government concept is a real challenge for any researcher. The width of academic fields that are

covered by Government 2.0 concept creates the basis for a diverse scientific research approach.

E-Government is also part of political and social sciences, in which a lot have to be thoroughly studied and analyzed under various perspectives. Effects and impacts of use of information systems and online platforms to the political system, citizens' participation and social engagement in democratic procedures are the most important issues, as well as others that will emerge during the following years of use and evolution of Digital Government.

5. CONCLUSION

Electronic Government or E-Government is a new and inspiring academic field. More and more countries are adopting it or evolving the existing infrastructure and services. It is ready to serve modern societies providing innovative ideas, best practices and ingenious tools that are created in order to boost human activities and facilitate day-to-day lives of billions of citizens and workers around the globe.

All these have to work well, be effective and efficient, as well as ready to change and become better. This is where evaluation and benchmarking comes to provide with useful information and facts. As in any invention and technological project, there is a need to have a concrete scientific opinion on the current situation of E-Government. It is crucial to know exactly what different countries do and want from their digital government concepts, as well as measure their progress. This progress forms the overall global progress of the emerging modern technological and digital societies.

Additionally, evaluation and benchmarking reveals the real current status quo of technological development and progress around the globe. By analyzing results of many frameworks, is it apparent to form a basic perception about digital divide, emerging technology trends and government practices in the world. This interesting and useful facts are provided by sophisticated procedures created for each framework.

Until today, many serious and well organized efforts have been done by diverse stakeholders, having varied intentions and interests. However, evaluation and benchmarking frameworks are not yet complete. As analyzed before, existing indicator models are not advanced and mature enough. There is an obvious need for more scientific research, both theoretical and practical on how these frameworks can be better, more productive, holistic and easily adapted to quick technological and social changes. Fortunately, E-Government and E-Government policies and projects evaluation has attracted extensive interest by diversified researchers focusing on numerous aspects of this multidimensional scientific domain.

To conclude, on the basis of the aforementioned points and arguments, Electronic Government evaluation and benchmarking is essential, but complex and strenuous. However, it is also compelling and intriguing attracting many curious researchers on putting new efforts to make governments better and more successful, citizens of the world happier and science more beneficial for people and societies.

ABBREVIATIONS- ACRONYMS

E-Government	Electronic Government
G2B	Government to Business
G2C	Government to Citizen
G2G	Government to Government
ICT	Information and Communication Technologies
ITU	International Telecommunication Union
OECD	Organization for Economic Co-operation and Development
IT	Information Technology
UN	United Nations
EU	European Union
SMS	Short Messaging Service
E-mail	Electronic Mail
OGD	Open Government Data
UNDPEPA	United Nations Division for Public Economics and Public Administration
UNCTAD	United Nations Conference on Trade and Development
EVA	Economic Value Added
NPV	Net Present Value
ROI	Return on Investment
IT-PM	Information Technology Performance Management
AGIMO	Australian Government Information Management Office
MAREVA	Méthode d'Analyse et de Remontée de la Valeur
eGEP	eGovernment Economics Project
WEF	The World Economic Forum
W3C	World Wide Web Consortium
EGDI	E-Government development index
OSI	Online Service Index
TII	Telecommunication Infrastructure Index
HCI	Human Capital Index
MYS	Mean years of schooling

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