



A Comprehensive Framework for Measuring Governments' Digital Initiatives Including Open Data

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Abstract. Digital innovation and digital initiatives are generally recognized and considered to be the driving forces behind firm survival and success in the market. This is not the case in the public sector, where digital initiatives have suffered not only from a lack of research trying to explain them but also from a major lack of recognition of their importance. The government's eagerness to introduce more digital initiatives for better e-government plays an important role in advancing the country. Digital initiatives in several governments are being overlooked, even though these days, private companies are competing to provide their customers with the best products and services. In this study, important attributes and sub-attributes of digital initiatives by governments are identified so that we can get a clearer picture of the government's digital initiatives (GDIs). The attributes and sub-attributes are extracted and combined with the new, proposed attributes to make our all-encompassing framework (with the passage of time, maybe more attributes and sub-attributes can be added to the list). The identified attributes are either directly or indirectly related to projects under the government's digital initiatives, which include open data for more transparent and accountable e-governance. The developed framework has been applied to Greece and Pakistan; the authors of the underlying study belong to Pakistan and Greece, and one more reason behind this is to measure the difference between the developing and developed countries' GDIs and to evaluate the governments' digital initiatives (GDIs) with respect to each attribute and sub-attribute. This research will help people understand the problems that governments face with GDIs and maybe provide recommendations for further development initiatives.

Keywords: Governments' digital initiatives (GDIS) · Digital Governments · Open data initiatives · Digital innovation · E-government pillars · Greece · Pakistan

1 Introduction

Digital government initiatives is the use of information and communications technology (ICT) in the public sector to provide citizens, businesses, and government employees

high-quality oriented services [1–3]. Increased ICT access is vital for bridging the digital gap, promoting effective governance, and advancing sustainable development. Digital government initiatives have improved the delivery of public services, but their overall impact in developing nations such as Pakistan has been hampered by an abundance of rules and a slower adoption rate. Everyone has the right to expect quick services from the government and easy access to information that is correct and often complete [4]. Governments continue to be collectors, consumers, preservers, and creators of primary data and aren't realizing their full potential. Governments must modernize in response to rapid changes in society and the economy, and information technology may aid in this endeavor. In recent years, however, government e-services have not been sufficiently concentrated on citizens.

The 2022 United Nations E-Government Survey [5] reveals that several nations have implemented e-government initiatives and information and communication technologies (ICT) applications for the public in order to enhance public sector efficiencies and streamline governance systems in support of sustainable development. The government's digital initiatives can be motivated by the Sustainable Development Goals (SDGs). Leaders in e-government see innovative technical solutions to boost economic and social sectors that are falling behind. In the current global recessionary climate, the overall conclusion of the 2012 Survey is that governments must rethink e-government and e-governance [5], placing greater emphasis on institutional linkages and among the tiers of government structures to create synergy for inclusive, sustainable development. To reach this goal, it is important to broaden the reach of digital initiatives so that the government can play a transformative role by putting in place procedures and institutions that support sustainable development [5, 6].

The COVID-19 pandemic has proven the relevance of digitalization for the timely and efficient provision of government services. Digital services are basically the fruitful results of digital government initiatives for better service provisions. Countries with a proper road map for digital government initiatives performed well during the pandemic era, and they are confident that these digital initiatives will perform well in the coming days as well. Governments have developed the digital portals, where users may get a plethora of relevant information organized by topic, life cycle, or other chosen usage, are backed by technical advances that promote data exchange and successful optimization of cross-agency governance systems. Services personalization in the digital portals is becoming popular, and more and more countries are changing their content and presentation to suit different initiatives. Digital government initiatives may position the public sector as a demand generator for ICT infrastructure and applications. When government digital initiatives make up a large part of a country's gross domestic product (GDP) and the regulatory environment encourages the growth of ICT manufacturing, software, and related services, the effect will be stronger [4].

However, several developing countries in Asia, such as Pakistan, are not well versed in the provision of government's digital initiatives. There can be several reasons for this, such as technological, the economy, population, and the literacy rate. Governments lack a grasp of how to initiate digital initiatives and what actions must be followed for digital initiatives to be effective. What are the main attributes and sub-attributes of a government's digital initiatives, and how can a government implement them? For instance,

how can the government launch a digital initiative to increase transparency in government? The government might be able to give its people digital initiatives that use “open data” to improve transparency. To answer this research question, we developed a framework based on the extraction of determining factors for government digital initiatives, and then compared Pakistani and Greek governments to validate our framework. In this study, we will provide a theoretical and practical framework for successful governments’ digital initiatives along with the determining factors, which we call the attributes and sub-attributes of successful governments’ digital initiatives (GDIs).

Existing studies discuss government assessment frameworks such as the UN e-government survey [5], Open Data Watch (ODIN), the digital Economy and society index (DESI), and web-portal-based assessments [7], government structure and citizen engagement-based assessments [8], and government accountability [9]. In this study, we will combine all of these indices and define attributes and sub-attributes that evaluate government digital initiatives in conjunction with open data-based initiatives. To the best of our knowledge, our proposed framework includes open data as a digital initiative alongside other government digital initiatives, such as the use of AI and blockchain in government.

The main contributions of this research are:

- To extract and define the attributes and sub-attributes for the GDI’s framework development
- To categorize the digital initiatives provisioned by the government as “provided,” “not provided,” and “partially provided” based on our GDIs framework.
- To determine Pakistan’s and Greece’s current positions in government digital initiatives with the help of our developed framework
- To provide academics and practitioners a way to evaluate GDIs in any other country in the world.

The words “factor,” “pillars,” and “attributes” are used as synonyms in this study. The remainder of the article is structured as follows: The second section explains digital initiatives, e-governments, and advancements in ICT, considering research publications and grey documents. In the third section, existing factors to measure the success of digital government initiatives have been discussed. We added more factors (attributes and sub-attributes) to the existing factors to make it a more extensive study. A comparison has been drawn between Greece’s and Pakistan’s based on our developed framework. The fourth section describes how these two nations approach digital government initiatives and adoption patterns and their success based on the scale of service provision, such as “provided”, “not provided”, or “partially provided”. The final section concludes the research with the overall findings, limitations, and future work.

2 Literature Review

E-government is regarded as the initial stage of digital government. The Organisation for Economic Co-operation and Development (OECD) defines digital government as “the use of digital technologies as an integrated part of governments’ modernization

strategies to create public value” and that it “relies on a digital government ecosystem comprised of government actors, non-governmental organizations, businesses, citizens’ associations, and individuals that supports the production of and access to data, services, and content through interoperable technologies”. “E-government” is defined as “the use of information and communication technologies (ICTs), and the Internet in particular, by governments to improve government”. The digital governments initiatives play a vital role in the development of E-government. The pandemic has given the digital government a new lease on life and helped to define its role, both in the way it delivers digital services and in the new, creative ways it handles crises [10, 11]. The e-government ranking of the countries depends upon the difference factors such as country’s gross domestic product(GDP) and its e-government ranking, money is not the only important factor in the development of e- government [12]. According to the 2020 UN e-government survey, Denmark, Estonia, and Korea top the rankings [1]. During the last few years, COVID-19 affected governments, particularly municipalities, to pursue services using innovative technologies, but a vast number of people were unable to access digital services, as published in the UN e-government survey [5].

Most of the time, developing nations are compelled to devote resources to undertaking fundamental changes, such as e-Government, based on models that may not work in settings that are significantly unlike those in the developed world [13, 14]. In underdeveloped countries, a new field of study concerning digital-government-related issues and the usability of e-government websites is expanding, whereas public perspectives (participation) are receiving less attention [15]. Incorporating citizens into the policy-making process is one of the most significant benefits of using e-government services [16, 17]. Even if a new digital initiative or service is developed by the government, the laws related to these digital initiatives and services may slow down the adoption rate in the country [18–20].

Davison et al. (2005) argue that people develop a preference for citizen-centric and responsive e-government websites. In a number of developing countries, e-government websites are not available in native and local languages, indicating that e-government is meant only for a minority of educated individuals. The European Commission published the four key indicators as an e-government benchmark initiative (user centrality, transparency, key-enablers, and cross-border mobility) with the title “eGovernment Benchmark 2020: eGovernment that Works for the People” to measure e-government performance in Europe [7].

Recently, other studies have been published which considers the development and evaluation of e-governments. We used the term “digital government initiatives” for the “e-government development”. To measure the governments’ digital initiatives(GDIs), different attributes (pillars) and sub-attributes will be extracted from the literature Irawan et al., for example, provide two (2) evaluation models for government websites, with the two models divided into two components: technical and democratic deliberation. The first website evaluation model is the “Qiyuan Fan Website Evaluation Model”, which contributes to the e-services section of the pillars (in our study) by providing the financial transactions and the e-procurement sub-pillars of the comparison. The second model is the “Lee-Geiller & Lee Website Evaluation Model”, which also contributed to the transparency and e-services sub-pillars. The interoperability of services, coordination at

the national level, and error management are some of the sub-pillars of the e-government comparison [21]. The government website evaluation is a key part of the e-government comparison (digital government initiatives) as a whole [17, 22].

As Wu et al. said, "An efficient performance measurement system is essential for controlling, monitoring, and improving service quality in governmental organizations". Their contribution to the comparison is the "Government Structures" pillar, which focuses on the learning and growth of employees, which is an essential measurement of e-government initiatives. More specifically, the "government structures" have staff training and knowledge management, staff satisfaction, and internal communication, which are some of the sub-pillars. Wu et al. also proposed the "Citizen Engagement" pillar with the responsiveness to inquiries and complaints and the political efficacy sub-pillars of the comparison [8].

One of the most important parts of the e-government comparison is the accountability section. Ibrahim et al. have proposed a framework for the evaluation of accountability based on web-based accountability practices; their developed framework uses financial, performance, and political accountability as the main pillars for the evaluation models. We have selected the "accountability" pillar from Ibrahim et al. along with its sub-pillars for our study [9]. The "Use of Disruptive technologies" pillar is constructed based on the cutting-edge technologies for the e-government such as Fintech, block chain, and AI. The use of disruptive technologies is important to develop smart cities, and consequently, in developed countries, the governments are focused on the use of these technologies for digital government initiatives [23]. Finally, the state audit office of Hungary has introduced good governance pillars such as lawmaking, accountability, transparency, economic and financial sustainability, a model organization, and reasonable and effective financial management [24]. These good governance pillars are indirectly related to the digital government initiatives, and we have used them to extract some new sub-pillars for our study, such as accountability and transparency-related sub-pillars.

Different articles discussed the pillars, factors, or attributes to measure the success of digital government initiatives, but in this study, an all-factors-encompassing framework could be useful. For instance, previous studies mentioned the evaluation of government websites, citizen engagements, the role of staff training, accountability, technicalities, and government preferences to evaluate digital government initiatives. However, we evolved with more factors to measure the success of GDIs such as "government structures", "e-services by government", "use of disruptive technologies", "transparency", "accountability", and "citizen engagement" to make this study more comprehensive. Each main pillar has been enriched with sub-pillars as described in the literature, and we have added some more sub-pillars to elaborate more on the digital government initiatives such as "Use of disruptive technologies", where we have introduced some sub-pillars such as use of block chain, AI, and FinTech. In the transparency pillar, we have introduced a sub-pillar for the use of open, big, and linked data for transparent e-government as a digital government initiative. This is the uniqueness of our study among others in that we have considered open data as a digital government initiative for the evaluation of e-governments.

3 Proposed Methodology

The entire procedure is depicted in Fig. 1. This study began by extracting the most essential digital government attributes, features, properties, pillars, and sub-dependent attributes. These characteristics are essential for measuring the government's Transparency and accountability in a systematic manner. In Sect. 2 of this research, the attributes or pillars that are directly or indirectly important to digital government are taken from the published literature and policy papers by researchers and governments. Government structures, E-services, the use of disruptive technology, transparency, accountability, and citizen engagement are the six characteristics of digital government. After extracting the six primary attributes of digital government, the next step is to carefully identify sub-attributes associated with each of the six core attributes.

Regarding government initiatives, this list of characteristics is not comprehensive; there may be many more. Several countries may have distinct perspectives, policies, and standards for digital services, for instance. One important point of view is that the government may have missed out on some digital services because of the high cost of technology devices and budget constraints. Each attribute and sub-attribute are exhaustively defined and discussed in the next section. This research can be used in the future to analyze the available services and orientations that are superior in one nation and inferior in another. The Greece and Pakistan have been chosen for the validation and application of our developed framework. We have used the snowball method to search the attributes and sub-attributes for both countries. There was no conflict of interest while deciding about the attributes' and sub-attributes' availability in each country because we just visited the official government websites to find out the relevant information. The reason behind the selection of these countries is that the authors belong to these two countries, and the validation of the framework will be quite easy to perform.

This study will help us trace the two nations' digital government advancements in each field. This is the age of the fourth industrial revolution, and it may be important to find the areas that need more attention to improve governance and, indirectly, make governments more accountable and open. We are aware that several countries are facing financial troubles because of the current global epidemic, making these attributes even more crucial. There may be further obstacles like these outbreaks in the future. There is a unique answer to every situation; it is the utilization of technical solutions to improve the future by putting residents' needs first. In the evaluation of governments' digital initiatives, the government structure such as population, area, ministries, staff training, and internal communication mechanisms are to be measured for each country. This information will help estimate the cost of the digital initiatives and their effectiveness.

E-services are also significant in digital governance. And the government can readily provide a variety of e-services to end-users in a timely and effective manner. Innovation with disruptive technology is also an essential factor to consider while evaluating digital governance. IOT, block chain, FinTech, robotics, cloud-computing, and AI are disruptive technologies to provide the finest services ever to citizens [23].

Transparency in government is a crucial metric for determining the efficacy of the government and its policies. The sub-attributes of transparency are significant and aid in exploring opaque government areas for future improvement. Public sector digital accountability evaluates the effectiveness of previous policies and decisions. This helps

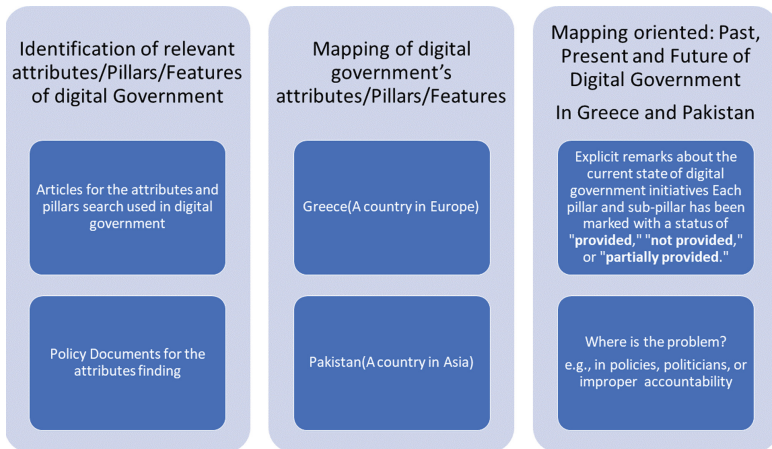


Fig. 1. Proposed methodology for extracting government attributes and sub-attributes and exploring their roles in Governments (e.g., in Greece and Pakistan)

improve governance and reduce poverty by making sure that government programs meet their stated goals and the needs of the people they are meant to help. Participation of citizens is essential for effective governance. It allows private individuals and groups to inform, influence, monitor, and assess public choices, procedures, and actions. The primary objective of public involvement is to foster significant public input during the decision-making process. Therefore, public involvement facilitates communication between the public and entities that make decisions. The other important factor is the corruption index in developing countries. Several politicians are creating problems in the way of digital government. Greece and Pakistan are also listed in the corruption index published by World data and Transparency international [25]. Focus must be placed on the digitization of government financial flows in order to build transparent and accountable governments. The Digital Economy and Society Index (DESI) is a second index that uses predefined indicators to measure how well digital services work in European countries. The European Commission has been using the DESI index since 2014 to measure the digital progress in the member states of Europe. The DESI key areas are very helpful for comparing the progress of countries, but we added a few other indicators as well, such as the use of disruptive technology and its sub-attributes in the public sector [26].

4 Findings and Experiences

Table 1 explains the pillars of E-government and applied these pillars to Greek and Pakistani government. We used the ministries website, and their initiatives websites to illustrate the current situation in each electronic pillar in e-government. This study helped us to evaluate the digital government initiatives. The countries evaluated in this study were Greece and Pakistan. For the comparison of digital government initiatives, Greece is a developed country, selected from the European continent, and Pakistan is a

developing country, selected from the Asian continent. The purpose was to elaborate on the differences between the digital initiatives in both countries. There are three scales used to indicate whether a specific GDIs pillar or sub-pillar is “provided”, “not provided”, or “partially” given. This comparison assisted in determining where developing countries lag behind developed countries in digital government initiatives.

The Pakistani government had been evaluated based on the identified pillars and sub-pillars of digital governments initiatives. Pakistan touched upon every aspect of the digital government but during the evaluation, there are some obstacles in the way of digital government initiatives: a few of them are the lack of information technology management system, low financial conditions, corruption, less user-oriented services, and political instability. The one more important finding of this study was that the Pakistani government gives just a few datasets to the citizens about the government activities for the transparent government (open government data). For instance, open government data initiatives are not very effective, that’s why the Pakistani government is not very transparent. The improved digital government in Pakistan may help in smooth information flow from government to citizens, citizens to government, and also within the government institutions. Consequently, the digital government in Pakistan will help in advancements of administrative activities, improve the economy, and at the same time improve transparency.

The Greek government over the last years is on the right track to achieving those pillars. First of all, in the “E-services by government” section of the pillars, Greece provides good practices, and several services are provided in the online platform of the Greek government but there are not all digitally enabled to the citizens and that is another step that needs to be taken in order to provide quality of service. Moreover, the “Use of Disruptive technologies” part of the evaluation is another good example for the Greek government. There are lots of initiatives that took place in Greece and the government is in the right direction. That also applies to the “Transparency” pillar, based on the specific sub-pillars and indicators the Greek government is on the right track. On the other side, over the last few years, it is noticed a lack of citizen engagement, with no initiatives and actions to encourage citizens to participate in the policy process or to provide feedback on common problems that they are facing. Citizen engagement is a crucial indicator of an efficient digital government, and the Greek government must provide initiatives in order to be productive.

There are several indicators to assess the performance of the digital government, such as digital economy and society index (DESI) designed by European commission (EC), United nations long-standing questionnaire for the e-government assessment. In 2017, the Tallinn Ministerial Declaration developed a monitoring tool “the digital single market vision and broader EU2020 goals”. This tool monitors and is used by the EC to provide information about the use of ICT in the public sector [3]. These indicators used some specific areas to assess the progress, but we focused on the depth version of each indicator, such as pillars and sub-pillars. In this article, we extracted the pillars and sub-pillars from the literature and policy documents and added a few of our own developed indicators, such as the use of disruptive technology in digital government initiatives. We compared two countries, one from European and the other from the Asian Continent. We also devised a scale to measure the progress of each pillar and

Table 1. Pillars to measure the governments' digital initiatives along with Pakistan and Greece comparisons

Pillars	Sub-pillars	Description	Greece	Pakistan
1. Government Structures [8]	1.1 Ministries	The number of ministries in the country	19	32
	1.2 Number of services	The number of services provided from the online portal	1,399	not mentioned
	1.3 Population	The population of the country	11 Million approx	230M approx
	1.4 Area	The countries' area is in square kilometers	131,957 km ²	881,913 km ²
	1.5 Staff training and knowledge management	Training and development practices adopted by the public sector will help in defining policies better. Training also brings measurable changes in knowledge skills, attitude, and social behavior of the employees	[Provided] The Greek government has several institutions for better staff training. However, there are some financial and management constraints	[Partially Provided] The Pakistani governments also train through several programs but due to lack of resources, inadequate financing and technological gadgets, it is difficult to achieve the desired output. e.g., the staff training institute is an example of this initiative
	1.6 Internal communication	Internal communication promotes the valuable role that staff play in communicating your messages and ambitions and ensures that no one misses important information or updates	[Provided] Proper communication within public administration contributes to the efficient operation of the public body and the quality of service to citizens. For achieving this, training seasons and workshops should be done in regular basis. A good example of the procedure is the OECD learning and consultation workshop .	[Partially Provided] The internal communication mechanisms are available in Pakistan. Fewer ministries implemented this for instance, FBR arranged workshops for the improvement of internal communications
	1.7 Government initiatives	The number of government initiatives that took place in a country	[Provided] In the last 3 years the e-government initiatives from the Greek government have been exceptional. The problems raised by the pandemic boost the effort of the Greek public sector. One of the most noticeable initiatives is the online platform of the Greek government	[Provided] The government initiatives are very common and can be found on the Pakistani government official website. These initiatives have several problems (tax, and financial limits) due to international monetary fund sanctions (IMF)
2. E-services by government [23, 27]	2.1 Online request for services	The availability of online portals for the service demand should be active. For instance, few departments book appointments via a phone call, and some of them use email as well	[Provided] Several services are provided in the online platform of the Greek government. The available services are based on "life events" (birth, insurance, setting up a business, etc.) while the user can also browse all the services per ministry, institution, organization, or independent authority	[Partially Provided] less online environment is observed in the Pakistani government structure. Sometimes, they did not have HR resources to respond to many requests
	2.2 Financial transactions	Financial transactions are very important nowadays. Every person has mobile phone and internet bank account as well	[Provided] In the last 2 years, digital transactions have rapidly increased. Citizens use digital transactions in their daily life. However, not every service provides online transactions	[Provided] The financial transactions are common via different banking applications and local mobile services as well. Due to money transfer limits and taxes people use less of these mediums for their business

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Table 1. (continued)

Pillars	Sub-pillars	Description	Greece	Pakistan
	2.3 E-procurement	E-procurement is very helpful to decide which company was better in previous projects and vice versa. The E-procurement also reduces the business	[Provided] The process of requisitioning, ordering and purchasing goods and services is provided by the main portal e-procurement.gov.gr .	[Partially Provided] Not all the departments are following the e-procurement. Pakistani governments usually use the print media for procurement tenders
	2.5 Interoperability of Services	The interoperability of service is important, for example, if any ministry wants to access the national identity database, then it could be feasible for them to make an interoperable transaction within ministries or government departments. Although, governments are working on international/cross-border interoperability of services	[Provided] In the Greek public sector there are many cases of systems that work separately, and without any connection. The important thing is that the online platform of the Greek government has interoperability capabilities as well as some of the central services of the public sector (e.g. <i>e-EFKA</i>)	[Partially Provided] To some extent services are interoperable. For instance, the National Database and Registration Authority (NADRA) has several partners, but other departments are not following true service interoperability
	2.6 Coordination at the national level	Coordination is also important. For instance, in the disaster management concept each department should coordinate for better problem tackling. The Covid-19 was an example, when National health institutions coordinated with other departments	[Provided] The coordination at the national level can be seen by the Greek digital portal <i>gov.gr</i> . The online platform provides coordination to some of the public bodies, but there is not the desired level of support	[Partially Provided] Several departments coordinate to tackle the bigger problems such as in flood times Pakistani several institutions coordinate but in passive mode. They should adopt a proactive mode
	2.7 Content organization and guidelines	The content organization and guidelines for the platforms and portals is very important, otherwise accessibility to information will be reduced	[Partially Provided] Based on the Greek <i>e-Government Interoperability Framework</i> , there are directions and standards to be followed by the public agencies at central or local levels. Unfortunately, not all public bodies follow the guidelines	[Not Provided] The paper free project is not truly initiated in Pakistan and that is why content management and organization is not locatable in several institutions
	2.8 Error management	Error and log management should be installed in E-services to make the delivery smooth	[Provided] Most of the ministries are under the "gov.gr" domain. That means backup protocols and error management guideline are implemented on the websites	[Partially Provided] Error management is important to recover the online services in no time. Backup mechanism is implemented in NADRA and some judicial applications
	2.9 Privacy and safety	The platforms and e-portals should use some security measures such as secure certificates and secure URLs	[Provided] Personal data protection guidelines based on GDPR are implemented on most of the ministries' websites. After the authentication process, the transmitted data is deleted from the files of the service provider	[Provided] Privacy and safety measures are observed in a few ministries. Privacy policies are implemented in NADRA. Pakistan is also developing personal data protection rules.
	2.10 Sustainability of e-services	The sustainability of the e-services should be considered while conducting some kind of feedback loop. The social media team of the government must be active to make the E-service improved with the passage of time	[Provided] The digital transformation of the public administration in Greece is the key to the sustainability of e-services within the public sector. The implementation of the <i>digital transformation strategy</i> for the Greek public sector leads to the improvement of existing digital public services as well as the creation of new digital public services for the benefit of citizens	[Partially Provided] The sustainability of e-services is implemented by just a few ministries such as NADRA implements this, but railway, Pakistan international airlines (PIA), Police, and federal investigation authority avoid sustainability of E-services. For instance, few ministries have fewer HR resources to deal with larger service demand

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Table 1. (continued)

Pillars	Sub-pillars	Description	Greece	Pakistan
	2.1.1 E-Agriculture	E-agriculture is important. For instance, if an area wants an abrupt response against locust attack the E-agriculture portal will help them	[Provided] The Hellenic Republic Ministry of Rural Development and Food website is an important portal for farmers and other stakeholders. This portal provides multiple web services for stakeholders from fruit and vegetable trafficking announcements to e-services for spraying machines	[Provided] The E-agriculture projects are highly encouraged in Pakistan, but it should be standardized for all provinces. One example of e-agriculture is the agriculture department initiative for crops, water and farmer management
	2.1.2 E-Health	E-health portals played important roles during the Covid-19 or any other virus which affected the world	[Provided] Based on the ministry of Health website there are numerous initiatives, for instance, the design and implementation of the Greek National eHealth Interoperability Framework (NEHF) according to European directives, regulations, and international standards	[Provided] The government of Pakistan has built an e-health service ¹³ in the form of personal identification cards that securely save health histories and patient data, enabling clinicians and insurers to make informed decisions based on consistent patient histories. Oladoc, dswHERS, Sehat Kahani, Commission on Science and Technology for Sustainable Development (COMSATS), eVicesPrime Minister National Health Program, and Aga Khan Development Network e-Health Resource Centre (AKDN eHRC) are digital health initiatives
	2.1.3 E-Energy	The billing service of electricity, gases, and other sources should be provided by the E-energy platforms. The electricity shortfalls, and other communications must be made through the use of ICT	[Partially Provided] Although there are platforms for online electricity payment, the Greek public sector does not have a one-stop platform for these procedures. The lack of proactive services in the field of energy is something that must be sorted out	[Partially Provided] Different energy and petroleum ministers use the portals to manage the complaints and other queries. Pakistan lacks the availability of energy sharing mechanisms among the provinces using technology as other countries have
	2.1.4 eJustice	The jurisdiction in the form of the internet for the criminal cases management. Several institutions can use this technology. For instance, Airport security must be able to use the e justice portal to control the movement of criminals	[Partially Provided] The Hellenic Republic Ministry of Justice has several ICT projects submitted on its website as well as some statistics from the Criminal proceedings from 2016. However, any other data from previous cases are not online	[Partially Provided] The ministry of law has a website for sharing the notifications, but they don't share the previous cases information online. One project for lawyer help online is <i>ejustice</i> (this is a private project)
	2.1.5 ICT education	ICT education should be provided by the help of some computer labs at an early age	[Provided] The ICT implementation in the education system of Greece is increased over the last few years. The <i>Greek Research and Technology Network</i> is a state-owned enterprise that operates under the authority of the Greek Ministry of Education's General Secretariat for Research and Technology. Its purpose is to offer high-quality infrastructure and services to Greece's academic, scientific, and educational communities, as well as to spread information and communication technology to the general public	[Partially Provided] Pakistan doesn't have such self-initiative for the improvement of ICT education, but other countries' NGOs are working in Pakistan to increase ICT use and education. e.g., UNESCO

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Table 1. (continued)

Pillars	Sub-pillars	Description	Greece	Pakistan
3. Use of Disruptive technologies [5]	3.1 Internet of things(IoT)	IoT is emerging and several countries are using this for smart cities and countries projects	[Provided] There are some good examples and practices of IoT technologies in Greek government. The Greek state is currently developing the big.gov.gr portal while also presenting a network guide of 135 sensor stations for the monitoring of environmental indicators	[Provided] There are a lot of examples regarding the use of ICT in Pakistan, but very limited benefits. For instance, a smart city project uses IoT to monitor traffic. However, bad road conditions and other factors hinder the IoT project
	3.2 FinTech	Like private companies, government should improve the use of FinTech for better management of finance using the technology initiatives	[Provided] In the last years, the Greek government made some significant initiatives in the field of finance. Two financial actions are the Digital Step and Digital Leap aimed to provide businesses in all sectors with investments in ICT	[Provided] In order to raise knowledge about financial resource management in the country, the government has launched Financial Literacy Programs for young people
	3.3 Artificial Intelligence (AI)-Robotics	AI and Robotics is emerging, governments should facilitate the youth for BioTechnology and other better projects. Several countries have robots at restaurants and hospitals, e.g., usage of robots to care for COVID-19 patients	[Provided] The Greek government has made the digital transformation as a top priority. Therefore, Greece actively implements European artificial intelligence policy and rules. The Hellenic Ministry of Digital Governance is currently in the final stages of developing its national AI strategy . Another AI policy initiative in Greece is the AI Center of Excellence coordinated by the National Center for Scientific Research "Demokritos."	[Partially Provided] President of Pakistan announced the initiative program for artificial intelligence, cloud computing, and blockchain for the future. Presidential for Artificial Intelligence & Computing (PIAIC) . Several other education sectors are working on cutting-edge technologies, but in this regard, government initiative and financing are limited
4. Transparency [17, 22]	3.4 Cloud-Computing	Cloud based services are very important in populated countries	[Provided] Cloud computing is becoming the norm in modern society. One of the bright examples of the operations that took place in Greece is the GRNET research infrastructures including Grid, Cloud, and HPC mentioned in 3.6. GRNET has created and managed its own public IaaS cloud solution, Oceanos , which provides cloud resources to Greek universities	[Provided] PIAIC is also dealing with the cloud computing sector to prepare the generation for the fourth industrial revolution, programs like PIAIC should be increased
	3.5 Blockchain	Blockchain is famous for decentralized version of ledger technology and provides basis for the smart cities and digital oriented countries [23]	[Partially Provided] Distributed ledger technology (DLT) is under the use for the tourism safety, and supply chain management during the covid-19. Greek government also used the DLT to improve health care sector services	[Partially Provided] Pakistan is using the DLT for the remittances purposes in the banking sector to attract the workers in Malaysia. This initiative is forced by the Financial Action Task Force (FATF) to control the terror financing and money laundering
	4.1 Open Accessibility	The data, products, and services provided by the government should be accessible and transparent on its own	[Provided] Not every data, product or service is provided by the Greek government, but every public service is accessible via the Greek online portal with information about the services	[Partially Provided] Most of the time, the services and products provided by the government are not properly conveyed to the end-users. Unlike in other countries, they do not share the services through a single portal or website. Individuals can access the services and products online, but some may waste a lot of time trying to find them

(continued)

Table 1. (continued)

Pillars	Sub-pillars	Description	Greece	Pakistan
	4.2 System availability	The system should be available without any disruption	<p>[Partially Provided] The demand of users is greater than the system capacity. As a result, the Greek digital platform has some availability problems, especially during the pandemic crisis</p>	<p>[Partially Provided] The number of users is greater than the system's capacity. The number of queries is much higher than the available resources. Most of the time, we find the systems are unavailable for certain services, for instance, examination portals in Pakistani school boards and job portals</p>
	4.3 Quality of information, open data, big, and linked data Portals and platforms for E-government	<p>The quality of information should be evaluated before dissemination to avoid any future problems. The portals and platforms also play an important role in transparency of e-government</p> <p>Big data and linked data plays an important role in understanding the semantics of data from different departments of governments in less time. Open data platforms are the need of this technological and fast computing era. For instance, open data is important for government's transparency and accountability. The open government data projects should be initiated for better citizen-oriented governance</p>	<p>[Provided] As mentioned in 3.12 the new open data portal provides quality real-time data, in contrast to the old version that there were no evaluation proceedings for the datasets quality of every dataset is low compared to the new open data portal. Open, big and linked data initiatives can be seen in the Greek open data portal. There are 10 different topics (e.g. Business and Economy, Education and others) with 47 datasets available. The previous version of the open data portal has more than 10000 datasets from 340 public services but the quality of every dataset is low compared to the new open data portal</p>	<p>[Partially Provided] In Pakistan, open data portals and initiatives are still relatively unknown and unproductive. 349 datasets are available. Most of them are following the Berners-Lee 5-star model up to 2 stars. To improve the quality of data, government ministries should stress the benefits of open data quality for better transparency and accountability. One major example regarding the use of big data in Pakistan is for statistical purposes. The Pakistan statistics bureau is using big data technologies. Although, it required more efforts for the use of big data technologies, Open data portal of Pakistan provides the data by 22 organizations and 349 datasets of Pakistan. Just a few ministries are providing the open data. The open data project needs to be extended for better transparency and accountability in the Pakistani government. The open data is just based on data that is given in any format, and no project has been found that looks at data in RDF format</p>

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Table 1. (continued)

Pillars	Sub-pillars	Description	Greece	Pakistan
5. Accountability [9, 24]	5.1 Financial	Financial accountability is important to avoid the corruption problems in developing countries, e.g., to control the black money	<p>[Provided] There are some priorities of the Greek fiscal policy. First, the further strengthening of fiscal reliability to reestablish trust in the economy's medium-term prospects and reestablish access to international capital markets. Second, equitable distribution of macroeconomic adjustment costs and assistance to vulnerable households. Gradual adaptation of the fiscal policy mix in order to boost productivity and maintain a sufficient growth rate. Further information in the Greek Ministry of Finance website.</p>	<p>[Provided] Public Expenditure and Financial Accountability Framework (PEFA) has defined seven pillars of PFM (public financial management) which includes budget reliability, transparency of public finances, management of assets and liabilities, policy based fiscal strategy and budgeting, predictability and control in budget execution, accounting and reporting and, external scrutiny and audit. Federal Board of Revenue (FBR) and Finance Division Pakistan.</p>
	5.2 Political	Political accountability should be implemented via ICT for a transparent government, e.g., Panama papers, Pandora papers could be the issues in later stages in case of unfair political accountability	<p>[Partially Provided] Based of the Sustainable Governance Indicators (SGI) Greek executive accountability is in the lower-middle ranks internationally. Candidate lists and agendas are often controlled by political party leadership circles. Citizens are misinformed about government policies because of the prevalence of political and infotainment-focused news</p>	<p>[Partially Provided] In developing countries, political instability and IMF sanctions are two of the main things that weaken them. Political instability has been seen in Pakistan since the beginning. As a result, political accountability is somewhat difficult to achieve. Several organizations are working for political accountability in Pakistan such as National Accountability Bureau (NAB)</p>
	5.3 Performance	The government performance accountability should be evaluated with pre-decided indicators such as GDP, and economy improvements	<p>[Provided] The key indicators of the government performance accountability show a noticeable deficit in 2020, as GDP in the pandemic period of Greece presents negative growth</p>	<p>[Provided] The government's performance accountability is a key factor. The GDP, stock exchange indices, and inflation rate are key performance indicators; better lives for citizens; and, most importantly, citizen satisfaction cannot be overlooked</p>
	5.4 Health	The most important sector of the government. Its accountability and transparency are important by examining the facilities in health sectors	<p>[Provided] National Health System services are provided by a combination of public facilities and a huge number of private providers hired by EOPYY. The pandemic crisis has proved that the creation of an effective network of primary care services to fulfill population requirements is by far the most pressing demand in the health system</p>	<p>[Provided] Ministry of national health services regulations and coordination (NHSRC) is working to make health procedures more efficient. There are other health institutions with the help of China and Iran contributing towards the health initiatives</p>

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Table 1. (continued)

Pillars	Sub-pillars	Description	Greece	Pakistan
	5.5 Law	The law must be followed by the citizens and politicians for better accountability of government initiatives	[Not Provided] Citizens do not receive adequate knowledge of government policies because the media is either heavily politicized or leans toward entertainment, and individual members of parliament seldom address substantial policy concerns with voters in the electoral districts that they represent	[Partially Provided] The Ministry of law and justice in Pakistan deals with legal accountability. Moreover, Pakistan's supreme court and high courts are also held accountable for the law and justice. There are few courts and few opportunities for justice, and hundreds of thousands of cases go unresolved
	5.6 Technological	The manual processes of the government need to be replaced with technological solutions for better and fast accountability	[Partially Provided] The technological accountability in Greece has significantly increased over the past few years. However, there are many cases of unstable and untrusted systems in the public sector	[Not Provided] Technological accountability is less adopted in Pakistan. A lot of work needs to be based on automatic processes, so till this time, no organization is working for technology-based accountability. Although technology-based applications are evolving in Pakistan,
6. Citizen Engagement [17, 28, 29]	6.1 Political Efficacy	Political efficacy is desirable for the stability of democracy. That is because modern democratic societies tend to provide citizens with the power to influence the action of their government	[Provided] E-participation empowers citizens by ensuring better interactions, increasing access to information and services, and boosting public participation in policy and decision-making using information and communication technology. The Greek government has made some significant steps towards better citizens' engagement with the online Greek platform "gov.gr". However, some basic e-participation features have been missing (e.g., online forum in "gov.gr")	[Partially Provided] Political effectiveness depends upon citizen involvement. There are several programs for political efficacy. One of them is the Citizen Portal for Overall Government. Although every other ministry should have a citizen engagement program for better political efficacy
	6.2 Responsiveness to inquiry/complaints	Ensuring that public service complaints are handled effectively is a key feature of good governance and a good service to deliver	[Provided] When dealing with complaints, each of these public organizations follows its own internal procedures. As a result, there is sometimes uncertainty among the many stakeholders about the efforts being made by other entities and how to maximize efficiency while managing an excessive number of case reports	[Partially Provided] The Prime Minister also listens to the public questions on a live telecast. However, there is a problem with service delivery in Pakistan, where there is a mismatch between population and service availability. Citizen Portal for complaints and tracking system is used, but several cases where never responded because of classism

(continued)

Table 1. (continued)

Pillars	Sub-pillars	Description	Greece	Pakistan
	6.3 Direct communication with elected government officials	Bringing issues of importance to the attention of those elected and communicating with government officials is an avenue for every citizen who wants to be heard	[Partially Provided] The number of direct discussions with the citizens for each elected candidate is subjective. However, most elected officials increase discussions with citizens during the election period and limit them during their period of service	[Partially Provided] It depends upon the individual electorate. Sometimes it is very difficult to approach the individual national assembly members after the election to ask them about the problem. There is no mechanism for communication
	6.4 Encouragement/promotion of participation	The primary goal of public participation is to encourage citizens to have meaningful influence into decision-making processes	[Partially Provided] The majority of citizens are unaware of government policies. Those who are, however, express their policy views in a variety of ways. Citizens, for example, can engage in an open electronic consultation process on proposed government initiatives, which each ministry must notify and oversee before writing a law	[Not Provided] There is no initiative to raise the involvement of individuals in participatory government. There are a few people who have access to social media, and they control the other person's point of view. Most of the population just have their problems with the inflation rate and daily basis expenses. Controlled social media and printed media is trending in developing countries
	6.5 Sharing the products and outcomes created through collaboration	This will enhance the creativity of the citizen for better thinking to develop the cross-border collaborative products, and services	[Provided] The Hellenic Republic Ministry of Foreign Affairs website presents announcements, statements and speeches in collaboration with other countries. For instance, it presented the third Strategic Dialogue between Greece and the United States	[Provided] One example is the collaboration with China's government, such as CPEC for Gwadar port, the Orange Line Project, and metro bus projects are a few examples of these projects. The Ministry of planning, development and special initiatives deals with these matters
	6.6 E-participation of citizens	Online feedback via portals, mobile applications, google forms, or contact us page, messages, and emails improve the e-participation of the citizens for the improvement of services based on the demands. This will create a citizen-oriented government architecture	[Partially Provided] On the side of the municipalities, some websites provided complaint and suggestion forms, allowing individuals to participate actively. However, more steps need to be done to promote contact between the government and citizens. Citizens' engagement would be increased if forums, communities, and blogs were supported	[Partially Provided] Federal and provincial gateways exist. Locals have protested late wages, traffic congestion, forced conversions, and delayed health, education, judicial, and infrastructure services. The Prime Minister's Performance Delivery Unit created the Pakistan Citizens' Portal app in 2018 to increase citizen participation. The government complaints portal. Portal is available at government agencies

sub-pillar, such as “provided (if service is available)”, “not provided (if service is not available)”, and “partially provided” initiatives in digital government as shown in Fig. 2. We transformed “provided (if service is available)”, “not provided (if service is not available)”, and “partially provided” into 1, 0, and 0.5 real values, respectively. We calculated the mean for each main pillar based on these values, and the results are shown in Fig. 2.

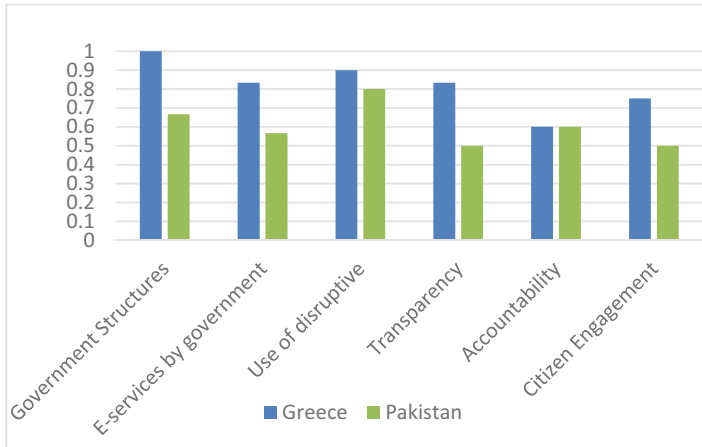


Fig. 2. Greece and Pakistan comparison based on their digital initiatives

5 Conclusion

In this research article, we devised a framework to compare the digital initiatives of the governments. Pakistan and Greece’s initiatives in the field of electronic government are highlighted in the light of our developed framework. In light of our devised plan, a government (e.g., Pakistani and Greek) may elaborate on their weakest and strongest points towards e-government for better transparency and accountability. Other governments may also use this evaluation framework to evaluate and later optimize the futuristic view of e-government. Digital transformation for governments requires governments to consider the systemic use of disruptive technologies such as we tried to elaborate on all the key pillars of digital government. There are several other indicators used to measure the success of digital governments, such as Open Data Watch (ODIN), which provides indexes for each country based on their openness and coverage, but our proposed framework considers the 6 main pillars and several sub-pillars to evaluate the E-government. According to the ODIN score, Pakistan has a score of 43 based on openness and coverage, but Greece has a score of 60. Consequently, our study also proved, based on the GDIs framework, that Greece is much more advanced than Pakistan. In this study, we focused on which sectors of the government need to be improved for better e-government. This framework will show how each pillar and sub-pillar needs more monitoring and development to help governments move up the rankings of different

indices like EDGI, DESI, and ODIN and, as a result, give their citizens the best services using digital technologies. Our developed framework is not limited to the assessment of Greece and Pakistan's digital initiatives; the framework is applicable to other countries' digital initiatives assessments as well. More attributes and sub-attributes related to government digital initiatives may emerge in the future, and this framework will be able to adjust for the new attributes and sub-attributes.

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