

Technologies Applied to Public Administration. A Perspective of Digital Government a Global Level.

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Abstract.

From the 1990s, the public administration introduced in its activities the intensive use of technologies to make its processes more efficient. The goal is to provide better services to citizens. Since then, and derived from the new information and communication technologies, governments have evolved towards their digitalization. In this context, this article shows the evolution of digital government at a global level based on the comparison between countries with the highest degree of development in this area. Likewise, the most advanced cases in the application of new technologies in public administration are shown.

Keywords.

Digital government, e-government, information, and communication technologies.

1. Introduction

Generally, the use of information and communication technologies in governments worldwide can be included in a process that has developed in four major moments (Andersen and Dawes, 1991). The first is found in the late 1950s and the entire 1960s, which was characterized by the introduction of the computer. Years later, as a second moment, the governments of industrialized countries had mainframe computers to meet their own processing needs, such as information contained in population censuses (Gil-García and Luna Reyes, 2008). During the 1980s and early 90s, computer technology had a great increase. The birth of personal computers entailed a great deal of processing power. This caused the reduction of space and the cheapening of the equipment. Therefore, governments were able to acquire more computers, and thus began with the training of public officials for their use. By the beginning of the new century, the development of the internet and computer networks had created new opportunities for the development of applications and governance systems. This gave rise to a new moment in which the so-called information and communication technologies enter fully. Thus, the so-called "Electronic Government" was born, or for some other authors, also called: "digital government" (Gronlund and Horan, 2005).

In this sense, it is necessary to clarify the difference between e-government and digital government. The first refers to the use of information and communication technologies by governments towards citizens (the latter are passive). The relationship is unidirectional and is as it had been in the first decade of this century. For its part, the second, also takes as a reference to these technologies. But also, it extends them to the use by citizens to influence the government (citizenship is participatory). In this concept the link is bidirectional and current to our times (OECD, 2016). E-government was born in the United States of America. Especially, in 1998 in which it was used for the elimination of bureaucratic paperwork. President Bill Clinton issued a memorandum asking his administration agencies to build the necessary Internet e-government infrastructure by December 2000. With the entry of the new century, developed countries began to expand the use of e-government, mainly those belonging to the G7 (Group of Seven), such as: United States, Canada, United Kingdom, France, Germany, Italy and Japan. All of them with an advanced infrastructure in terms of information and communication technologies. It was not until 2001, when the United Nations tried to carry out the first studies on this subject at a global level.

2. Digital government at a global level.

2.1 Comparison methodology.

The United Nations Department of Economic and Social Affairs has conducted research on e-government, first of all, and then on digital government. This office has developed a measurement methodology to compare countries over the past two decades. Its measurements are based on two indices (UN, 2003):

a) The e-government development index. This has three main indicators:

- Network measurement index. This consists of a five-stage model where governments use the internet. The first is when there are no Internet pages. The second is when some ministries of state already have pages on the network with relevant information towards citizens. The third is when governments can already provide some services through the network such as licensing. The fourth is when the citizen can already interact with the government by paying various taxes through the network. Finally, the last stage is that citizens have a real deliberative participation in the actions of governments (elections).
- Telecommunications Infrastructure Index. This has the following indicators. Numbers of personal computers, internet users (fixed and mobile), telephone line users (fixed and mobile) and televisions per 1000 inhabitants.
- Human capital index. This is based on the educational level of the populations: primary, secondary, tertiary.

b) electronic participation rate. It is based on three main axes. 1) increase electronic information to citizens for decision-making; 2) improve electronic consultation for deliberative purposes and participatory processes; and 3) support e-decision-making by increasing citizens' participation in decision-making. This is done through a biannual survey of each of the countries that make up the UN.

2.2 Comparative appraisal.

In this way, it is relevant to present an overview of the countries with the greatest development in government and electronic participation. The measurements are made based on the already mentioned indices ranging from "zero" as the least development to "one" with the highest score. The UN has been starting these studies since 2001. But it will not be until 2003 where the indicators presented are combined and, therefore, can be comparable over time. (Table 1)

Table 1. Countries with the highest rate of e-government and participation 2003

Countries with the highest rate of e-government and participation 2003			
Position	Country	Government Index	Participation rate
1	United States of America	0.92706	0.9655
2	Sweden	0.83967	0.5862
3	Australia	0.83106	0.6207
4	Denmark	0.82046	0.4483
5	United Kingdom	0.81403	1
6	Canada	0.80644	0.8276
7	Norway	0.77814	0.3448
8	Switzerland	0.76351	0.4655
9	Germany	0.76164	0.5345
10	Finland	0.76112	0.4483

Source: UN E-Government Survey 2003.

As you can see, the United States led the ranking of positions. That's because it was the pioneer country in charting the e-government route during Bill Clinton's tenure. The list is made up of northern European countries such as Sweden, Denmark, Norway and Finland. Also, traditionally developed countries such as the United Kingdom, Canada, Germany and

Australia. That trend didn't change much for almost 10 years. It should be remembered that information and communication technologies primarily had in the first decade of the century the internet, personal computers and traditional televisions. It will not be until the 2010s when positions change. This was also due to the evolution of technologies with the emergence of smartphones, tablets, mobile broadband internet and social networks. In that sense, Asian countries entered the scene. The following Table 2 gives us an account of this.

Table 2. Countries with the highest index of government and e-participation 2012.

Countries with the highest rate of e-government and participation 2012			
Position	Country	Government Index	Participation rate
1	Republic of Korea	0.92832	1
2	Netherlands	0.91249	1
3	United Kingdom	0.89603	0.9211
4	Denmark	0.88885	0.5526
5	United States of America	0.86873	0.9211
6	France	0.86349	0.5789
7	Sweden	0.8599	0.6842
8	Norway	0.85931	0.6842
9	Finland	0.85052	0.7368
10	Singapore	0.84742	0.9474

Source: UN E-Government Survey 2012.

As can be seen in the table, 10 years later the position of honor is occupied by the Republic of Korea. It should be noted that even in the e-participation index it reaches the coefficient of "one", just like the Netherlands. The United States drops to position five and Canada does not appear in the top 10. In that position is presented Singapore which, until the middle of the last century, was still a colony of the United Kingdom. This trend is further accentuated in 2014. To do this, the following Table 3 displays the information.

Table 3. Countries with the highest index of e-government and participation 2014.

Countries with the highest rate of e-government and participation 2014			
Position	Country	Government Index	Participation rate
1	Republic of Korea	0.94623	1
2	Australia	0.91034	0.94117
3	Singapore	0.90762	0.90196
4	France	0.89384	0.96078
5	Netherlands	0.88966	1
6	Japan	0.88744	0.96078
7	United States of America	0.87483	0.92156
8	United Kingdom	0.86948	0.96078

9	New Zealand	0.86436	0.78431
10	Finland	0.84491	0.70588

Source: UN E-Government Survey 2014.

Two years later, South Korea still occupies the top position. Singapore climbed to third place. Japan appears in the sixth. With this, Asian countries begin to have importance in this matter. In a similar vein, we observe the cases of Australia and the recent appearance of New Zealand, nations of Oceania that are also leaders in this matter. The United States of America and the United Kingdom fall to seventh and eighth positions, respectively. Who continues to remain are the Netherlands and the relative surprise of the emergence of France as a traditionally developed country. Four years later the situation changes considerably. To notice the differences, it is important to pay attention to the next Table 4.

Table 4. Countries with the highest index of government and e-participation 2018.

Countries with the highest rate of governance and e-participation 2018			
Position	Country	Government Index	Participation rate
1	Denmark	0.915	1
2	Australia	0.9053	0.9831
3	Republic of Korea	0.901	1
4	United Kingdom	0.8999	0.9831
5	Sweden	0.8882	0.9382
6	Finland	0.8815	1
7	Singapore	0.8812	0.9663
8	New Zealand	0.8806	0.9831
9	France	0.879	0.9663
10	Japan	0.8783	0.9831

Source: UN E-Government Survey 2018.

As the information shows, the United States disappears from the top 10 countries with the greatest development of government and electronic participation. The pioneer in these issues is no longer the spearhead for the world. Now these positions are occupied, as they had been for several years ago, by Asian nations (South Korea, Singapore and Japan), oceanic (Australia and New Zealand), northern European (Denmark, Sweden and Finland), finally, traditional powers (United Kingdom and France). Although in 2020, the situation has changed moderately, that has been the trend in the second decade of the 21st century. The following is the latest data in the following Table 5.

Table 5. Countries with the highest index of government and e-participation 2020.

Countries with the highest rate of governance and e-participation 2020			
Position	Country	Government Index	Participation rate
1	Denmark	0.9758	0.9643
2	Republic of Korea	0.956	1
3	Estonia	0.9473	1

4	Finland	0.9452	0.9524
5	Australia	0.9432	0.9643
6	Sweden	0.9365	0.8214
7	United Kingdom	0.9358	0.9762
8	New Zealand	0.9339	0.9881
9	United States of America	0.9297	1
10	Netherlands	0.9228	0.9643

Source: UN E-Government Survey 2020.

With this information, it is highlighted that the United States of America reappears to ninth place. Singapore fell outside the top 10. It highlights that an ex-Soviet republic like Estonia ranks third. Japan disappears and its place has been taken by the Netherlands. Moreover, the same trends already mentioned remain relatively stable. The pre-eminence of the nations of northern Europe remains, as do the oceanic countries. The United Kingdom has been the only traditional power that has not disappeared from the top 10. It has always been among the countries with the greatest development in government and electronic participation.

3. Technological applications in government administrations. Relevant cases.

At present, it is worth highlighting some examples of technological application carried out by government administrations. It focuses on the countries that occupy the first places to show the potential and application of technologies at the service of citizens and government processes themselves.

3.1 Denmark. Digitalization of social life.

Through the Digital Strategy 2016-2020, Denmark has attempted to digitize the entire government through a simple and easy-to-use public sector. It also aims to make better use of personal data, more efficient processing of requests and improve the services of the Welfare State. In recent times they introduced online digital medical consultations for people with chronic disorders, digital learning tools and availability of public sector information online at no charge to citizens. This is done with close collaboration between citizens, entrepreneurs and the government itself to face the digital world (<https://en.digst.dk>).

3.2 South Korea. Transparency in the control and use of technology in waste management.

Since the global economic crisis of 2008, governments have increased social welfare spending, which has limited public administration finances. In South Korea, the fiscal crisis was triggered by problems of corruption of public officials and poor management of local governments. This led to greater transparency in the spending of public finances. In that sense, the Korean tax system is based on management control to ensure transparency through citizen participation. However, it is not a legal requirement to make spending transparent in this Asian nation. However, Chungcheongnam-do County raises the need to disclose tax information at 100% in the expenditure and use of taxes. In this way, a platform has been created where the budget expenditure can be observed in real time and shows the amount of money spent so far. It consists of several aspects such as a medium-term plan and sustainable development indicators. In addition, a part of questions and suggestions was attached where citizens can participate to solve their doubts in the expenditure of the budget.

On the other hand, garbage collection is a major problem in large cities. Seoul, the capital of South Korea, uses garbage bins for citizens to deposit there. However, these were insufficient, or the cleaning service did not pass frequently to take the waste. This caused accumulation of garbage in the streets, and with it, the growth of urban fauna harmful to health. In order to reduce this problem and improve the urban landscape, the Seoul government installed 85 solar-powered garbage compactor containers so that more waste could be deposited. These containers help store more trash and also communicate the information they collect about their filling in real time to the city's cleaning service so you can move on to emptying them as soon as possible before they are filled.

Since the installation of this system, overflow was avoided, the cost of collection was reduced by 83%, recycling was increased by 46%, and the frequency of collection was reduced by 66%. This technological solution has allowed the local government to maintain a cleaner city with fewer environmental health problems (<http://gov.seoul.go.kr/>).

3.3 Estonia. The electronic one-stop shop, access to information and electronic voting.

This country has developed a network of computer applications called "X-Road". This allows all government services to be available in one place, giving materialization to the electronic single window. In addition to offering consultation mechanisms in different databases, this system integrates different portals of government offices to carry out practically any procedure. In this way, "X-Road" has made it possible for 99% of government utilities to be fully online. On average, 500 million queries are performed per year using this network of computational applications. It is estimated that, with the use of this electronic one-stop shop, up to 800 years of time in bureaucratic work can be saved. Estonia has shared this technology with Finland, Azerbaijan and the Faroe Islands. A shared cross-border digital data exchange network between Estonia and Finland has even been implemented, making X-Road the first cross-border public data exchange platform (<https://eestonia.com/solutions/interoperabilityservices/x-road/>).

On the other hand, in the capital of Estonia, Tallinn, the local government has as an obligation to respond to any request by email with indications to the citizen of the time in which his request will be carried out. Of course, the lapse depends on the magnitude of the petition. However, the average wait is 5 business days for a request for information. If it is the resolution or explanation of a problem, the waiting time is a maximum of 30 working days. In this way, the citizen is given the certainty that their requests are met and with a security of response to increase confidence in the government and, above all, in the use of these technologies. With the help of the national government, a tax information disclosure system was established that links 15 local governments throughout the country. In terms of expenditure, the methods of public works contracts, the content of those contracts and the contracting parties were made transparent. With this, fiscal surveillance has been expanded and transparency and efficiency in fiscal spending has been maximized(<https://www.nts.go.kr>).

With regard to voting, in 2012 an Electronic Voting Committee was established, which is responsible for supervising this modality in parallel with the National Electoral Committee. It is done through the internet and does not require any other device such as electronic urns or special devices. This form of voting was introduced in the 2005 local elections, where more than 9,000 voters cast their ballots online. Although it only corresponded to 2% of the electoral roll, it marked an important milestone for citizen participation. From there, more votes have been made with this model. The most important are the parliamentary elections of 2007, 2011, 2015 and 2019. This system has also been used for the European Parliament elections of 2009, 2014 and 2018 (UNDESA Member States Questionnaire 2018).

3.4 Finland. Digital participation as a democratic principle, use of blockchain for refugees and application of technologies in cities.

Of course, democratic values govern Finland's political life. Now they are trying in the digital world with the implementation of the Government Opening Act of 1999. Based on it, the Register of Government Projects and the "otakantaa.fi" website have been developed to promote public debate on government proposals. This site is only available in Finnish and Swedish. It also allows any citizen to suggest initiatives or make comments at the national and local level. One of the most conspicuous propositions is that more than 50,000 signatures can be collected so that they can be forwarded to parliament and evaluated for legislative reform. For those people who are not accustomed to the use of digital services, the Ministry of Finance established an Advisory Council, composed of civil society organizations and academics to guarantee access and daily use for the population that does not know the digitalization of government (UNDESA Member States Questionnaire 2018).

Between January 2014 and June 2017, the Finnish immigration authority received more than 41,000 asylum applications. Of those who were accepted, they faced long waiting times to process residence permits and local identity. During this period, refugees could not access the banking system and tax payments by this population had to be made in cash. In 2015, the government launched a pilot financial services program that allows refugees to receive money and pay bills without having a bank account in the country. This service simplifies payments made by refugees to the Finnish government for access to social security services. This is done through a prepaid debit card system linked to a unique digital identity stored on a blockchain that does not require identity documents or bank accounts in the traditional financial system. In this way, the holders of these "blockchain" accounts can transfer and receive money from their places of origin through a cell phone. Each of the transfers is secured by the block chain. In 2017, the program had 4,000 active accounts, and transfers increase as they gain residency and find work, allowing them to transfer money to family members and pay bills from the Finnish tax system. The purpose of this program is to expand to the European Economic Area, which would allow a greater number of transactions to refugees

who do not have residence on the European continent. All you need is a cell phone, a residential address and to register in the blockchain system associated with the government itself (<http://migri.fi/vastaaanottoraha>).

Helsinki's "Infoshare" service aims to make the city's information accessible quickly and easily to its inhabitants. This is a website where statistical data are offered on urban phenomena, living conditions, economy, employment and even urban traffic of this metropolis and its conurbation. This information can be used for scientific research, decision-making, journalistic activities, etc. Likewise, they can be consulted by the citizens themselves, companies, universities or the local administration itself. The data is free and can be processed in different home storage programs such as computers, cell phones or tablets(<http://www.hri.fi/en/>).

3.5 Sydney, Australia. Local citizen participation.

This city provides a variety of opportunities for its citizens. Through digital chats they can participate in workshops and community meetings, round tables, online consultations, reference groups, advisory panels, walk-in sessions, school workshops, etc. The results of consultations and participation are collected, analyzed and considered as inputs to the decision-making process of the local city council. This participation is governed by the principles of integrity, inclusivity, dialogue and influence to make effective the collaboration of citizens(<http://www.cityofsydney.nsw.gov.au>).

3.6 Texas, USA. Maternal care through text messages.

The "Text4Baby" program is a Texas government initiative that provides information to pregnant women and new moms on how to care for themselves, their baby during pregnancy, and in the infant's first year of life. This program is aimed at women who live in a disadvantaged environment and who do not have access to the internet. Despite these problems, it is very likely that they have a cell phone, so this initiative sends them text messages in English or Spanish once a week. The evaluation of this initiative has had a high acceptance rate. In addition, it contributes to the increase of the knowledge of the users about maternal care. Also, better engagement with health care providers and greater acceptance of vaccines. "Tex4Baby" is a partnership between the Texas government and non-profit civil society organizations of more than 700 partners. Despite using a simple technology, it has shown its effectiveness by being very focused on a priority group such as disadvantaged pregnant women(<https://www.text4baby.org/>).

As has been seen, the countries with the highest rates of digital government have tangible strategies for technological application. These range from basic technologies such as the use of text messages to the blockchain. All of them serve to be more efficient in their public management, and of course, for citizen participation. Both, pillars of digital government.

4. Conclusions.

Throughout this paper, what is meant by electronic government and its evolution in digital government has been analyzed. It was observed that this began with greater force in the United States and in traditional economic powers such as Canada, France, Germany or the United Kingdom. However, in recent years there has been a trend where Asian countries (South Korea, Singapore), oceanic (Australia, New Zealand), Nordic (Denmark, Sweden, Finland) and even ex-Soviet republics such as Estonia have taken the lead in this matter. This is because they have been able to channel the use of new information and communication technologies (blockchain, social networks, electronic votes or artificial intelligence) in their public administrations. The tangible application examples are a sample of the way in which the governments of these countries have not stagnated in the use of personal computers, cell phones or the internet. What is exposed in this article is focused on the countries that are spearheading digital government. More questions remain to be answered: what happens in other less developed regions such as Africa or Latin America? Of course, their progress is much less. But, without a doubt, they will also deserve a specific study.

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