

# Emergent technologies and digital services in the public sector

## Digital transformation in government: Trends and legacies of the pandemic<sup>1</sup>

By *Manuella Maia Ribeiro*,<sup>2</sup> *Javiera F. Medina Macaya*,<sup>3</sup> and *Luciana Piazzon B. Lima*<sup>4</sup>

The COVID-19 pandemic has accelerated the use of digital technologies by public organizations in several countries as they seek to ensure access to services and information by the population, especially during measures such as social distancing. Information and communication technologies (ICT) played a key role in responding to the health emergency and were directly used in addressing COVID-19 (Organisation for Economic Co-operation and Development [OECD], 2020).

In this health crisis context, inequalities among public organizations were exacerbated, evidencing the different capabilities available for

rapidly mobilizing the technological resources required for dealing with its impact (Ribeiro et al., 2021). In Brazil, in addition to the differences found at the various levels of government, in the local context digital technologies were adopted in an uneven manner depending, in particular, on the size of the municipalities (CGI.br, 2022c).

Based on data taken from the ICT Electronic Government 2021 survey (NIC.br, 2022b), this article addresses the main changes that occurred when municipal public organizations started incorporating ICT during the pandemic. Focusing on digital transformation within local governments, the analysis begins with an approach to the provision of digital public services during this period. It then deals with the main changes introduced in the means of contact offered to citizens for communicating with the public authorities, and the challenges faced in terms of privacy and data protection in the context of increased online interaction. It finally concludes with general considerations and recommendations for the advancement of digital government after the most critical period in the pandemic.

<sup>1</sup> This article is based on the ICT Electronic Government 2021 survey, conducted by the Regional Center for Studies on the Development of the Information Society (Cetic.br), of the Brazilian Network Information Center (NIC.br). The presentation of the data and conclusions of the study are based on an analysis of the results previously published by the Brazilian Internet Steering Committee (CGI.br, 2022c).

<sup>2</sup> PhD with a master's degree in Public Administration and Government from the São Paulo School of Business Administration of the Getulio Vargas Foundation (FGV EAESP), she is a researcher at the Coordination of Survey Projects at Cetic.br | NIC.br, where she leads the ICT Electronic Government and ICT Public Access Centers surveys.

<sup>3</sup> Doctoral candidate in Business Administration with a master's degree in Public Administration and Government from FGV EAESP, she is a researcher at the Coordination of Qualitative Methods and Sectoral Studies at Cetic.br | NIC.br.

<sup>4</sup> Master's degree in Cultural Studies and bachelor's degree in International Relations from the University of São Paulo (USP), she is a researcher at the Coordination of Qualitative Methods and Sectoral Studies at Cetic.br | NIC.br.

### Digital public services

Digital government initiatives are characterized by their use of ICT to facilitate access to public services by society (United Nations Department of Economic and Social Affairs [UN DESA], 2020). In the context of the pandemic, the provision of electronic public services was relevant for maintaining government activities and offering programs to mitigate the impacts of the health crisis. In Brazil, an example of this was the establishment of emergency aid (Auxílio Emergencial), a federal program of supplementary income that could be requested via mobile phone application (CGI.br, 2022b).

The provision of digital public services during the pandemic took place in an emergency context, in which the necessary adaptations for online interaction sometimes took place in an improvised way. A legacy of this experience, however, is that governments should increasingly consider implementing strategies based on hybrid and inclusive by-default models, since “one-size-fits-all” and digital-by-default initiatives tend to exclude marginalized populations, such as women and girls, older people, migrants, and refugees (UN DESA, 2022).

The ICT Electronic Government 2021 survey provides inputs for analyzing the main actions of local governments used to offer online services during the pandemic period. This happened via different channels (including websites, social networks, instant messaging applications, and own specific applications), which depended largely on the existing level of appropriation of technologies and local capabilities for adapting to this new scenario.

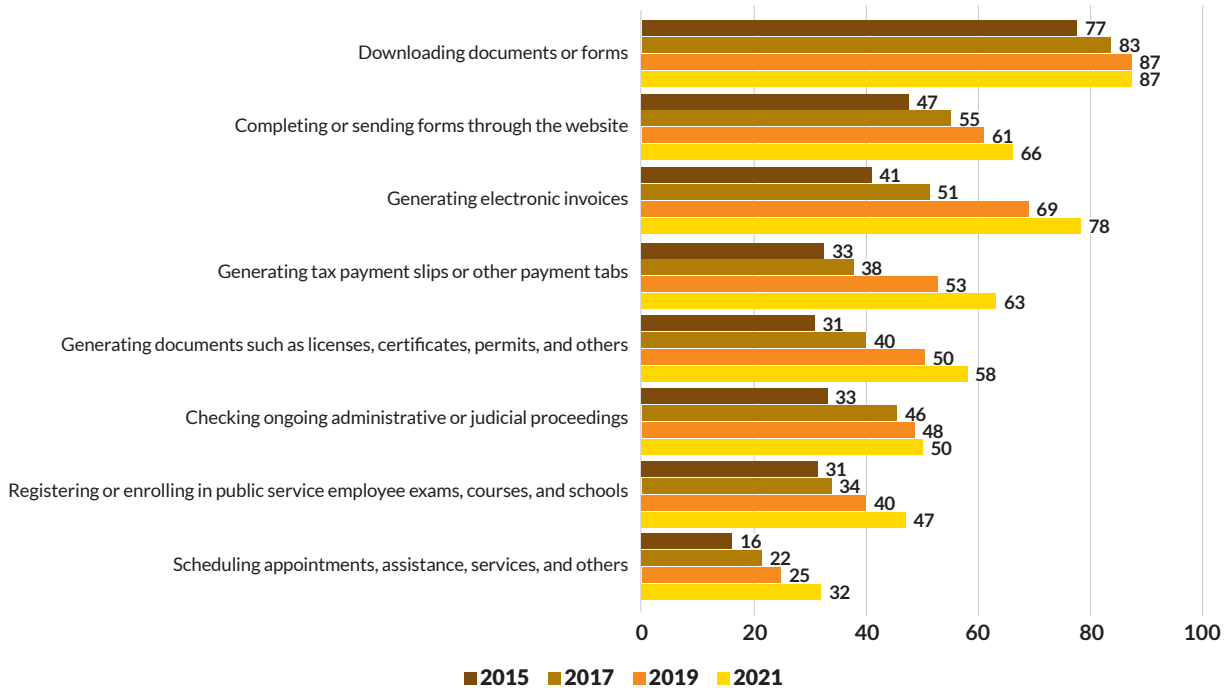
In 2021, 96% of Brazilian local governments had an official page on the Internet, with websites being universally available in state capital cities and in those with more than 100,000 inhabitants. There was an increase in the use of websites offering citizens digital services in practically all the services investigated by the ICT Electronic Government survey, confirming the trend observed in previous editions (Chart 1). Although this trend predates the pandemic, the health emergency has amplified and accelerated the process. Between 2019 and 2021, the greatest growth occurred in services for generating tax payment slips or other payment tabs (from 53% to 63%), electronic invoices (from 69% to 78%), and documents such as licenses, certificates, and permits (from 50% to 58%): that is, transactional services associated with financial transactions and the issuing of documents.

There was also a relevant increase in services associated with access to public policies, such as registering or enrolling in public service employee exams, courses, and schools (from 40% to 47%), and scheduling appointments, assistance, and services (from 25% to 32%). Even though these are the only services offered via websites by less than half of the local governments, the increase in their use reveals that even activities predominantly performed in a face-to-face manner required the expanded use of ICT in the context of the crisis.

The provision of digital public services during the pandemic took place in an emergency context, in which the necessary adaptations for online interaction sometimes took place in an improvised way.

**Chart 1 – LOCAL GOVERNMENTS, BY TYPE OF SERVICE AVAILABLE ON THEIR WEBSITES (2015 - 2021)**

Total number of local governments with websites (%)



Source: NIC.br (2022b).

Despite the increase in the availability of services via websites, disparities persist according to the size of the municipality: the larger the municipality, the higher the proportion of the provision of these services via this channel. In the case of registering or enrolling in public service employee exams, courses, and schools, for example, the service is made available by about 45% of those municipalities with up to 50,000 inhabitants, while it reaches 86% of those municipalities with more than 500,000 inhabitants.

The trend toward less digitalization of services in small municipalities was also evidenced in a qualitative study conducted by Cetic.br|NIC.br in municipalities with fewer than 20,000 inhabitants (CGI.br, 2022a). The results indicated that there was a greater online offer of information services than transactional services, which indicates that the use of digital technologies is more common for publishing information than for processing transactions related to citizen services and access to public policies. It should be noted that in order to offer transactional services, the local government needs to have a large technology infrastructure. In this sense, the study also highlighted the fact that small municipalities have low local capabilities in ICT and indicated the fragile institutionalization and professionalization of the information technology (IT) area, besides the lack of financial resources (CGI.br, 2022a).

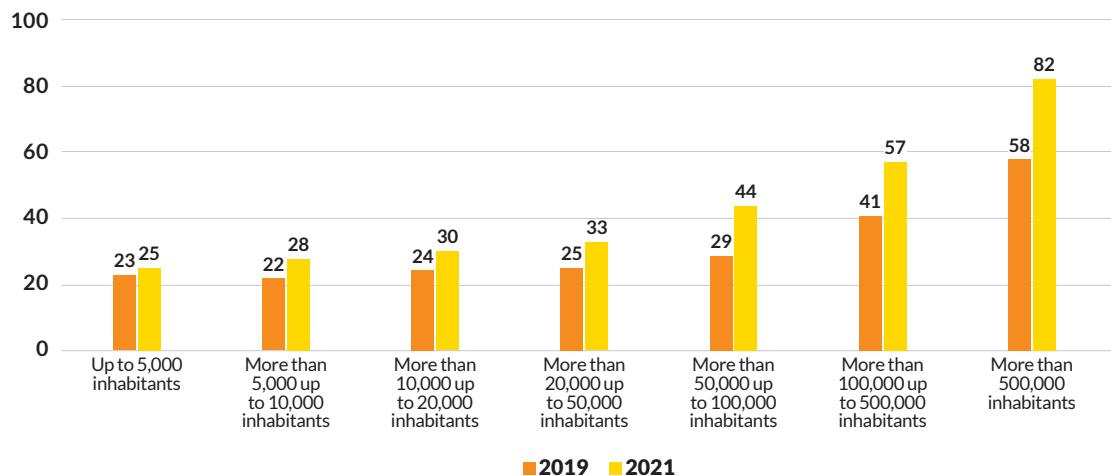
In addition to this existing disparity, the provision of online services when faced with the emergency scenario was also greater among larger municipalities. Although the proportion of services offered via the website increased in all the city size ranges analyzed, it was more significant in municipalities with more than 50,000 inhabitants, and had the greatest reach in relation to 2019

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in those with a population above 500,000 inhabitants. This is shown by the example of those municipalities that made scheduling appointments, assistance, and other services available (Chart 2).

**Chart 2 – LOCAL GOVERNMENTS THAT OFFERED SCHEDULING APPOINTMENTS, ASSISTANCE, AND SERVICES ON THEIR WEBSITES, BY SIZE (2019 AND 2021)**

Total number of local governments with websites (%)



Source: NIC.br (2022b).

Similarly, barriers to the provision of digital services, including in large cities, have also been identified by other studies. In 2020, the Local Online Service Index (LOSI), created by UN DESA and conducted with 100 municipalities around the world, found that local governments tend to score higher on dimensions involving the presence of technologies and the provision of content than on the provision of online services (UN DESA, 2020). In Brazil, the information and services provided online during the pandemic in state capitals and the largest cities were focused on information services, with a lower presence of distance services, such as teleconsultations and emergency aid requests (Przebilovicz et al., 2022), demonstrating that scaling up digital services remains one of the challenges for digital transformation at the local level.

## Communication and interaction on the Internet

In addition to the digital delivery of public services, the use of ICT by public administration has also made it possible to increase the means of communication relating to citizen services and the participation of society in government activities (Cunha & Miranda, 2013). This can include anything from actions aimed at broadening online interaction with society to measures that enable citizen participation in public sector decision-making via the Internet (UN DESA, 2020).

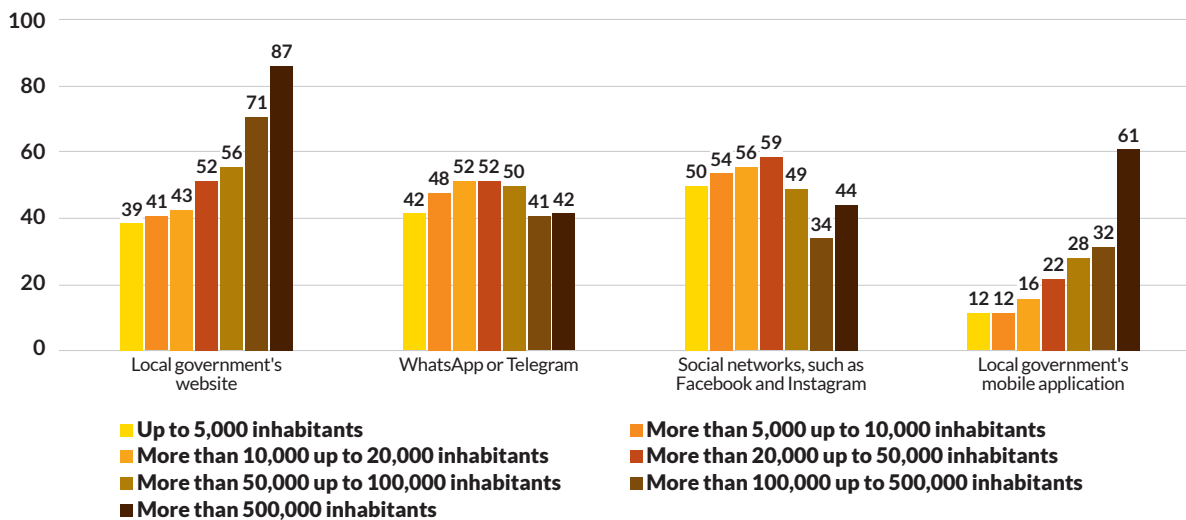
In the context of the COVID-19 pandemic, online customer service channels have made it possible to minimize barriers, thereby enabling the population to access services and information. According to data from the ICT Electronic Government survey, between 2019 and 2021, there was an increase in the

availability of means of contact with local governments for citizens to request public services (such as cleaning, repairing potholes, and lighting). Interactions via WhatsApp or Telegram were most frequently used in this case (from 28% to 48%), as were social networks such as Facebook or Instagram (from 45% to 53%). The telephone is still the mean of contact local governments make most available for this type of request (85%), while registering requests via the website is less frequent (46%). The availability of local government applications for this purpose also increased compared to 2019, rising from 11% to 17%, and of those cities with more than 500,000 inhabitants, 61% had an application that allowed this type of request.

It is worth noting that the provision of means of contact to request public services that require a better infrastructure and greater ICT capabilities – such as a website or mobile phone application – occurs mainly in large local governments, with more than 500,000 inhabitants (Chart 3). In contrast, the availability of instant messaging applications and social networks as a means of contact – such as WhatsApp, Telegram, Facebook, and Instagram –, is more prevalent in smaller local governments.

**Chart 3 – LOCAL GOVERNMENTS, BY MEANS OF CONTACTING A CENTRAL SERVICE LOCATION WHERE CITIZENS MAY REQUEST PUBLIC SERVICES AND BY SIZE (2021)**

Total number of local governments (%)



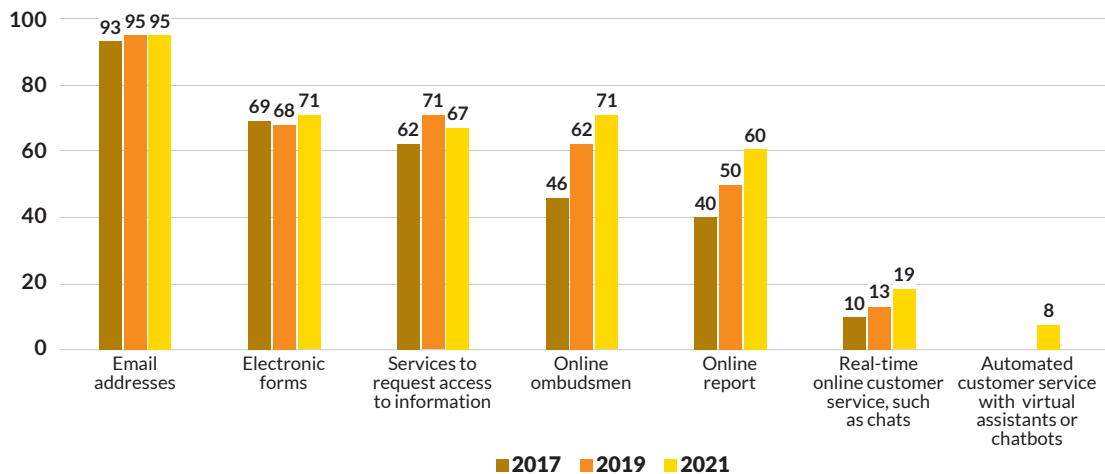
Source: NIC.br (2022b).

In relation to the presence of other Internet communication initiatives offered by Brazilian municipalities, the ICT Electronic Government survey shows that there was an increase in the proportion of local governments that made available an online ombudsman, an online report, and real-time online customer service via chats on their website (Chart 4). These means of contact are still used less than email (95%), especially in the case of chats with human assistants, which was cited by 19% of the local governments. With regard to the presence of virtual assistants or chatbots on the website, less than 10% of the local governments have adopted this type of automated interaction with citizens (8%); it was, however, more frequent among local governments with more than 500,000 inhabitants (36%).

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**Chart 4 – LOCAL GOVERNMENTS, BY TYPES OF CONTACT OFFERED TO CITIZENS ON THEIR WEBSITE (2017 - 2021)**

Total number of local governments with websites (%)



Source: NIC.br (2022b).

Finally, online presence via social networks also expanded: in 2019, 82% of the local governments had a profile on social networks, a proportion that reached 94% in 2021. During this period, there was an increase in the number of local governments with profiles on Instagram, TikTok, or Flickr (from 37% to 68%); WhatsApp or Telegram (from 24% to 45%); YouTube or Vimeo (from 23% to 40%); and Facebook (from 79% to 89%). The main activities carried out by local governments with profiles on social networks were posting news regarding the government organization (93%) and publicizing services and campaigns (91%), thus emphasizing the predominance of the use of such tools for providing citizens with information. Despite the increase in real-time online customer service with virtual assistants or chatbots (from 16% in 2019 to 20% in 2021), this type of interaction on social networks was mentioned in lower proportions, as was automated customer service with virtual assistants or chatbots (9%).

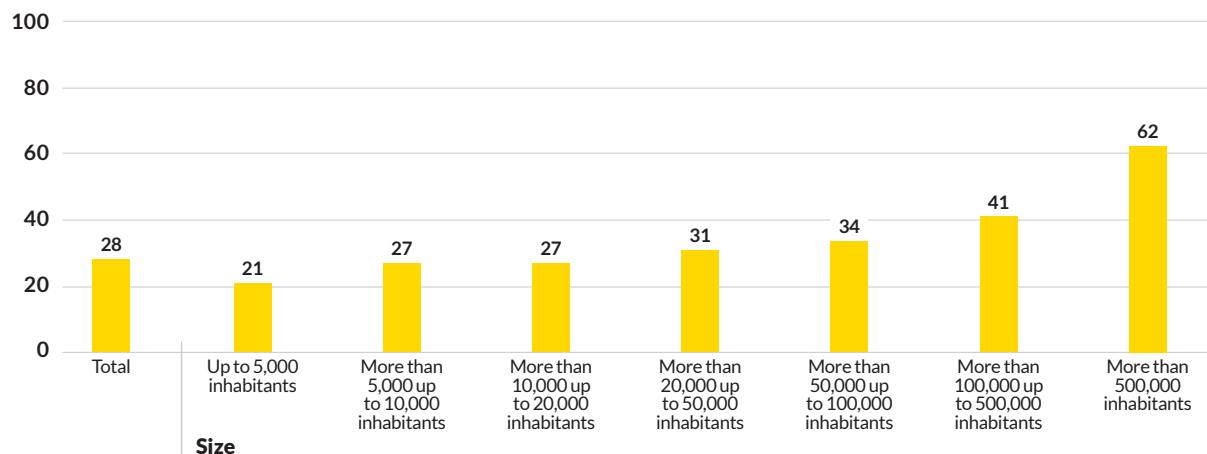
## Privacy and personal data protection

With the expansion of the means of communication between government and society, information sharing, and access to public services using technology, debates about the right to privacy and the protection of citizens' personal data are gaining ground (NIC.br, 2021). Enacted in 2018 and effective since 2020, the Brazilian General Data Protection Law (LGPD) defines the guidelines which individuals and organizations, including the public sector, must follow when processing personal data in Brazil using physical and digital media.

In seeking to identify how municipalities have been structured to adapt to the new legislation, the ICT Electronic Government 2021 survey found that only 28% of all local governments had an area or person responsible for the implementation of the LGPD. Only municipalities with more than 500,000 inhabitants had this type of structure in more than half of them (62%). Although most local governments do not yet have a structure dedicated to the LGPD, the data shows that the larger the population of the municipality, the greater the presence of initiatives in this area (Chart 5).

**Chart 5 – LOCAL GOVERNMENTS, BY WHETHER THERE WERE AREAS OR PERSONS RESPONSIBLE FOR PROCEDURES AND POLICIES FOR THE COLLECTION, STORAGE OR USE OF PERSONAL DATA OR FOR THE IMPLEMENTATION OF THE LGPD, BY TOTAL AND SIZE (2021)**

Total number of local governments (%)



Source: NIC.br (2022b).

Among the other LGPD-related measures investigated by the survey, the most frequently mentioned was the availability of online customer service channels for sending messages about the processing of personal data. Despite online contact means for citizens being widely available, however, this action was reported by less than one-third of the Brazilian local governments, and even among those with more than 500,000 inhabitants, only 36% had a channel for questions about personal data. The survey results suggest that local public organizations are still in the early stages of incorporating the law into their structures. This is a point of attention since, in addition to risks to security and privacy and personal data protection, the lack of institutionalization and active transparency mechanisms in relation to the processing of personal data may generate less trust in the services offered by public entities and affect the adoption of digital government by society (Bleeker, 2020; United Nations Capital Development Fund [UNCDF], 2021; UN DESA 2020).

As an example, data from the ICT Households 2021 survey (NIC.br, 2022a) show that privacy and personal data protection concerns are recurrent reasons for Internet users in Brazil not to use certain online services: more than half of those who have not used e-government services<sup>5</sup> mentioned concerns about data protection and security as a reason for not interacting with public entities digitally. Similarly, when investigating the perceptions of Internet users about the risks of making personal data available to governments and enterprises, the ICT Panel COVID-19 (CGI.br, 2021) identified that more than half of the users consider that the risks would outweigh the benefits of such sharing.

Another point of attention is the massive collection of data by public agencies, which must be carried out in conjunction with the technical means necessary for reducing or preventing the risks of violating citizens' rights, such as unauthorized access, loss of data, or discriminatory treatment (NIC.br, 2020). Such precautions become even more pressing with the adoption of emerging technologies such as Artificial Intelligence (AI), Big Data, and the Internet of

<sup>5</sup> In 2021, 30% of Internet users aged 16 or older had not used electronic government services in the 12 months prior to the survey (NIC.br, 2022a).

In the context of coping with the COVID-19 pandemic, the survey identified an increase in the provision of services using digital means. At the local level, the proportion of local governments that have made services available via website has increased, but inequalities still persist based on the population size of the municipalities.

Things (IoT), which rely on the processing of large databases. These technologies can have an impact, for example, on transparency, making it difficult to identify how personal data is processed or how public agencies use it for taking decisions (NIC.br, 2020; UNCDF, 2021).

## Final considerations

The crisis arising from the COVID-19 pandemic has leveraged the use of digital technologies by the public sector, including at the local government level. The results of the ICT Electronic Government 2021 survey, however, indicate that the digital public services and online communication and interaction channels offered to citizens have expanded in different ways in the context of Brazilian municipalities, depending on previously existing conditions, the resources available, and the installed local capabilities.

The mobilization of technological resources to offer citizens electronic public services is one of the very important strategies of the digitalization of the public sector (Ribeiro et al., 2021). In the context of coping with the COVID-19 pandemic, the survey identified an increase in the provision of services using digital means. At the local level, the proportion of local governments that have made services available via website has increased, but inequalities still persist based on the population size of the municipalities. Smaller local governments have made services available over the Internet to a lesser extent, which reinforces the need for specific strategies for dealing with the challenges of such locations.

With regard to the forms of online communication and interaction made available by Brazilian local governments, some trends were also revealed by the survey. Despite an increased presence on social networks and agile forms of communication over the Internet (including instant messaging via WhatsApp or Telegram), the adoption of tools that allow real-time interaction, such as chats with human attendants or virtual assistants, is still low, which could improve the provision of services and information to the population.

Given this scenario of digital transformation in the public sector with advances in the provision of online services and in the forms of interaction between government and society, Brazilian and international entities have pointed to the need to establish guidelines to minimize the potentially adverse impacts of emerging technologies in the social sphere, such as the expansion of inequalities and the violations of rights, such as privacy (NIC.br, 2020). Despite the existence of regulatory frameworks in Brazil – which has the LGPD and its Constitution, in which data protection is included as a fundamental right – the results of the ICT Electronic Government 2021 survey indicate that there is still little institutionalization of this in Brazilian local governments. It is essential, therefore, to understand the main difficulties that exist in relation to bringing the public sector in line with the country's legislation, in order to guide the actions that the entities responsible for compliance should implement.

In the context following the most acute period of the COVID-19 pandemic, it is essential that the progress noted by the survey be followed up on to monitor whether such initiatives have become an integral part of a municipal digital transformation strategy, and not simply emergency actions. Besides that, the expansion of digital government cannot be dissociated from ensuring that the whole of society has access to public services, which involves prioritizing the inclusion of the most vulnerable population in these initiatives.



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# Interview I

Photo: Personal archive



### Vitor Cipriano de Fazio

Coordinator of the Government Innovation Laboratory of the city of São Paulo – (011).lab

## Digital public services and innovation in government

Vitor Cipriano de Fazio is a career civil servant and a specialist in public policy and government management at the Ministry of Economy and Coordinator of the Government Innovation Laboratory of the city of São Paulo – (011).lab. The offer of digital public services and access to them, and technology-based innovation in government, with its respective advances and challenges, are topics addressed by him in this interview.

### ***Internet Sectoral Overview (I.S.O.)\_ Which were the main advances and challenges to the city of São Paulo's offer of public digital services during the COVID-19 pandemic?***

**Vitor Cipriano de Fazio (V.F.)** My perception is that governments faced many challenges in common, but the response capacity varied a lot – even within the same government, with significant differences existing between departments or ministries. As there is still much to be studied about this phenomenon, you should consider this to be only a partial and personal account. In my position I see that the biggest challenge was to take advantage of the wave of digitalization – that arose from the need for social distancing – to boost the agenda of digital services and include the views of citizens; that is, we had to do it quickly, but in a quality way, and not just digitalize the existing bureaucracy. The result leaves a legacy, not only of digitalized services but also of solid organizational processes and qualified people. As the São Paulo local government had been investing in digital government for some years, we had a relatively good response capability. Under the umbrella of the Municipal Department of Innovation and Technology (SMIT), for example, all our digital processes and information and communication technology (ICT)<sup>6</sup> governance and customer services policies<sup>7</sup> were conducted by teams that have undergone few changes since 2017. This institutionalism was fundamental when it came to the local government quickly adopting remote working with the minimum conditions for continuing the services. We also underwent the challenges that other governments faced: adapting processes to suit the remote, ICT infrastructure, among others. But the basis we had enabled us to look at opportunities beyond what was urgent, and we were able to develop relevant organizational capabilities on this path to making the government more responsive and closer to the people, and to offering better quality services.

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<sup>6</sup> Find out more: <https://tecnologia.prefeitura.sp.gov.br>

<sup>7</sup> Find out more: <https://politicadeatendimento.prefeitura.sp.gov.br>

In 2020, the Digital Services team successfully adapted the service digitalization process. More importantly, and despite this adverse context, the team included the views of citizens in the digitalization process, and experimented with and incorporated people-centered service design approaches. These practices were documented and will be published in the *Guia do Programa Copi Cola* (Copy Paste Program Guide) from the (011).lab.<sup>8</sup>

This need for digitalization and the more permissive environment for experimentation also provided opportunities for us to connect the digitalization of services with disseminating our capabilities. In 2021, with the support of CAF – development bank of Latin America –, the Digital Services team, and the (011).lab developed a methodology for digitalizing services that is also a platform for training civil servants in how to build services that focus on people. This enabled us to discover new ways of interacting with citizens and to explore tools, channels, and formats that would allow us to have access to different groups of people. Although this is a constant challenge in this agenda, we have a basis on which we can evolve on the way to introducing services that focus more on people's real needs, which structures the local government as a whole.

**I.S.O. In your opinion, how can digital inequalities affect access to public services? What measures can be adopted to mitigate the obstacles resulting from the population's lack of access to, and appropriation of technologies?**

**V.F.** The short answer is that since digital service is tending to become the standard, the more digitally excluded a person is, the less access they will have to services. The consequence of this is that social inequality will become worse, since there is a direct correlation between digital exclusion and factors such as income, age, gender, and ethnicity. So if the State wants to achieve its main purpose, which is to reduce inequality, it needs to: (i) act with regard to the causes of digital inequality; and (ii) adapt its channels and content to ensure accessibility.

The SMIT, for example, has specific programs for reducing digital inequality and mitigating the effects of the same, such as: *Wi-Fi Livre SP* (SP Free WiFi),<sup>9</sup> which offers free Internet access points in public places; *Telecentros* (Telecenters),<sup>10</sup> which offers access to the Internet and to computers, as well as basic to advanced digital literacy training; and *FabLab Livre SP* (SP Free FabLab),<sup>11</sup> which focuses on digital fabrication. These programs address three factors of digital exclusion: (i) access; (ii) skills; and (iii) the ways in which the Internet and technology are used.

But when we talk specifically about access to digital public services, the main measure that can be taken is getting to know the target audiences, their profiles, their needs, and the journey they take until the service is concluded: that is, incorporating service design approaches that focus on people. This makes it possible to understand how these digital exclusion

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<sup>8</sup> Find out more: <https://011lab.prefeitura.sp.gov.br>

<sup>9</sup> Find out more: <https://www.wifilivre.sp.gov.br/>

<sup>10</sup> Find out more: [https://www.prefeitura.sp.gov.br/cidade/secretarias/inovacao/inclusao\\_digital/index.php?p=246630](https://www.prefeitura.sp.gov.br/cidade/secretarias/inovacao/inclusao_digital/index.php?p=246630)

<sup>11</sup> Find out more: <http://www.fablablivresp.prefeitura.sp.gov.br/>

factors affect the journey or even prevent access to the service, which requires changes, or maybe even the maintenance of some face-to-face help.<sup>12</sup> For example, if a relevant profile of users only has access to the Internet via a mobile phone that has a prepaid plan, then the priority needs to be providing a low data consumption channel on this type of device. For those who have little education and poor digital literacy, then the interface and language need to be simple<sup>13</sup> in order to reduce the level of skill required to access the service – and we will only have clarity if they are simple enough if we test them with these audiences until we reach a solution that provides a good user experience.

***I.S.O. What are the main barriers to innovation in the public sector with regard to the adoption of digital technology? How does government innovation laboratories help develop capabilities in municipalities?***

**V.F.** Perhaps one of the main barriers is defining the role of digital technologies in organizations: they are tools that enable organizational processes; that is, they are not an end in themselves. They are “solutions” to problems that prevent the organization from delivering results, from achieving its purposes: in government, this means reducing inequality and improving people’s quality of life.

I feel that this is still a barrier to be overcome and is a recurring topic in discussions about digital transformation and innovation, as if transforming government involved incorporating technology, and was not about redesigning all other organizational functions (people, processes, procurement, etc.) so it can use techniques (and technologies) that improve its efficiency and effectiveness.

Government innovation laboratories have played an important role in experimenting, systematizing, and disseminating different ways of operating government. For example, we seek to develop and disseminate individual and organizational competences that increase the government’s ability to learn and adapt to changing needs in society.

Interestingly (or perhaps not), these are also the competences that increase the government’s ability to take advantage of the benefits of using technology: exploring and defining problems, focusing on people, experimenting, collaborating, getting to know and use data (qualitative and quantitative), and operationalizing projects. For example, one of the greatest benefits of using technology in enterprises is the possibility of collecting immediate and scaled reactions from users of the services, processing this data, creating solutions from it and trying out these solutions almost immediately, learning from this, and finally implementing improvements in line with the needs of the service users in order to increase their satisfaction.

"For those who have little education and poor digital literacy, then the interface and language need to be simple in order to reduce the level of skill required to access the service (...)"

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<sup>12</sup> An emblematic case was the redesign of the journey for issuing invoices by Individual Microentrepreneur (MEI). Find out more: <https://copicola.prefeitura.sp.gov.br/guias-publicados/como-reformular-servicos-a-partir-da-experiencia-do-usuario>

<sup>13</sup> Find out more: <https://011lab.prefeitura.sp.gov.br/linguagem-simples/inicio> and <https://www.redelinguagem-simplesbrasil.org/index.html>

But if we look carefully at these organizations, we will see that this is only possible because the operational processes, the structure, the management processes, and the development of people and knowledge, etc. were redesigned precisely so that they can interact with the user and quickly learn from that interaction.

This is the direction in which we are looking to go: a government capable of learning from each interaction with society and adapting quickly to deliver services and public policies that solve people's real problems.

***I.S.O.\_ What role does the participation of citizens, civil society organizations, and the private sector play in creating technology solutions for the public sector at the municipal level?***

**VF.\_** Citizens can have different roles to play in this process. They are, for example, the "owners of the problem," our target audience: if there is no interaction, we cannot define the problem to be addressed, so consequently there is every chance that we will come up with a useless solution. I have already mentioned this and the need for us to learn how to draw lessons from our interactions with society. But there are many other possible roles, including co-development.<sup>14</sup>

Non-governmental organizations (NGO) have research skills and flexibility, and they circulate relevant knowledge between governments – something that was very apparent during the pandemic. The new Brazilian Regulatory Framework of Civil Society Organizations (*Marco Regulatório das Organizações da Sociedade Civil* [MROSC]) introduced the possibility of forming medium-term connections between NGO and governments for them to work together and complement each other, based on their different capabilities, in a relationship of building and learning together, and not one of consultancy or occasional academic research. I still do not see this relationship extending, however, to include the code production process.

The private sector, on the other hand, is very diverse and can make its contribution because of this diversity. This requires, however, an internal capability on the part of governments themselves: they must use legislation (and any recent modifications to it) to establish formal connections with the private sector, either to buy technology or to act as a partner in solving public challenges. At this point, the challenge is more severe for municipalities, because they have less ability in management functions, in particular in specifying ICT solutions, legal frameworks, contract management, and other aspects related to the procurement function.

"This is the direction in which we are looking to go: a government capable of learning from each interaction with society and adapting quickly to deliver services and public policies that solve people's real problems."

<sup>14</sup> Find out more: <https://copicola.prefeitura.sp.gov.br/guias-publicados/prato-aberto>

# Article II

## Basic concepts about Artificial Intelligence in the public sector<sup>15</sup>

By María Isabel Vélez,<sup>16</sup> Mariutsi Alexandra Osorio-Sanabria,<sup>17</sup> and Cristina Gómez Santamaría<sup>18</sup>

Artificial Intelligence (AI) is a general-purpose technology that is expanding quickly and that is improving as it advances, supports, and complements other technologies, giving rise to a wide range of uses and innovations. It has a great potential to change the current economic and social dynamics, solve or – on the contrary – exacerbate many of the large environmental, social, and economic challenges of our time.

The increasing dissemination, development, and use of AI have been possible primarily due to the huge volumes of data available, the analytical techniques, and a sufficient computational capacity for processing them. A special highlight is the maturity achieved by one of its subcategories, the so-called machine learning or automated learning. This type of AI is based on cloud computing resources and the expansion of the digital economy, which includes new platforms and markets for products based on data (Stone et al., 2016).

While analyses and assessments about the potential of this technology have focused mainly on the private sector, the acknowledgment of public organizations as AI users has been increasing. This increment has been driven not only by the growing complexity of social demands or by the work of researchers and international organizations, but also by the governments themselves, which, as shown in this article, have gradually incorporated AI to strengthen their performance on different fronts.

Exploring the benefits to be gained by the public sector in this regard involves understanding certain technical aspects. This knowledge allows employees, for

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<sup>15</sup> This is an edited version of the chapter “Conceptos fundamentales sobre la Inteligencia Artificial en el sector público,” published in 2021 by the CAF – development bank of Latin America – as part of the *Experiencia: Datos e Inteligencia Artificial en el sector público*. The original text and the complete report are available at: <https://scioteca.caf.com/handle/123456789/1793>

<sup>16</sup> Economist, she holds a PhD and a master’s degree in Scientific and Technological Policy from the State University of Campinas (Unicamp), in Brazil. She has approximately 15 years of experience working in the fields of science, technology, and innovation in the academic world and the public sector. At the Administrative Department of Science, Technology and Innovation from Colombia (Colciencias) she has coordinated the interaction with the Organisation for Economic Co-operation and Development (OECD) Committee for Scientific and Technological Policy (CSTP) and led the Science, Technology and Innovation (STI) Policy Design and Evaluation Unit. As a member of the Center for the Fourth Industrial Revolution (C4IR) Colombia, she promoted the development of governance milestones for the digital technologies fostered by the Center: Artificial Intelligence (AI), Internet of Things, and blockchain.

<sup>17</sup> PhD candidate in Engineering with a master’s degree in Information and Communication Technologies from the Pontifical Bolivarian University and a bachelor’s degree in Systems Engineering from the Industrial University of Santander, in Colombia. She is a researcher and associated professor at the Engineering College of the Maria Cano University Foundation, in Medellín, Colombia, and a professor at the graduate program of the Engineering College of the Cooperative University of Colombia. Her research interests include digital government, digital transformation, data governance, open data, open access, and information technology management.

<sup>18</sup> Senior data scientist at Mercado Libre. Currently her main interests are focused on the technical development of AI applications in the real world, in its complete cycle, delivering value to business. She has more than 20 years of experience as a university professor and researcher, in addition to having led the AI team at C4IR Colombia and the AI team at Vozy.

example, to choose the methods or models that best fit specific situations or even guide the acquisition of solutions already available in the market. To this end, this article presents AI-related conceptual foundations, which are useful for bringing into the context of technology terms that are increasingly used, such as neural networks or deep learning. Finally, the focus is brought to the public sector, where the main opportunities offered by AI and the potential risks involved are explored, which require special attention in order to achieve its ethical and responsible use.

## What is Artificial Intelligence

AI is a field of study that refers to the creation, through the use of digital technologies, of systems capable of performing tasks for which human intelligence is deemed necessary. A simple definition, coined by Stanford University, describes AI as “that activity devoted to making machines intelligent,” adding that intelligence “is that quality that enables an entity to function appropriately and with foresight in its environment” (Stone et al., 2016, p. 12).

AI can be divided into rule-based or symbolic AI and non-symbolic AI. The former is developed from rules written by humans to describe a workflow and produce results, applying a conditional (if-then) sequence. Due to its relative simplicity, this type of AI is more suitable for low-complexity processes or problems, where few actors are involved, actions to be executed are few, and changes are not frequent (Berryhill et al., 2019).

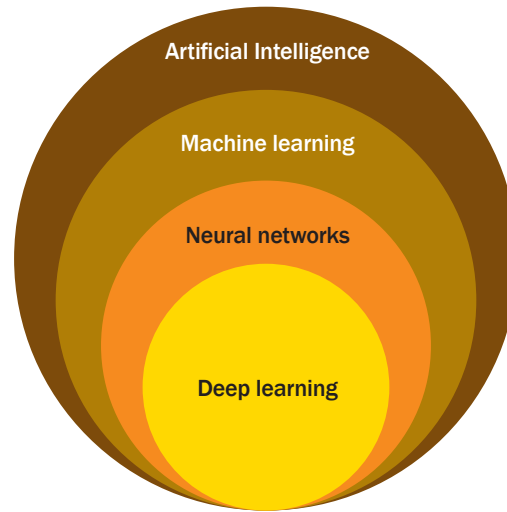
The use of symbolic AI can be a first step for public organizations to begin to familiarize themselves with the basics of the technology. As these systems prove insufficient for more complex processes, more sophisticated applications based on non-symbolic AI may be explored.

The latter refers to machine learning or automated learning, which consists of a series of techniques that allow machines to learn and make predictions from historical data, based on the identification of patterns, without the need for instructions from a human. The most interesting thing about this type of AI is that, instead of receiving knowledge through explicit rules, the systems are trained to obtain the knowledge and infer the rules by themselves, which allows their application in contexts where the processes or problems are not well defined. In recent years, machine learning has become the dominant approach, causing it to often be taken as a synonym for AI.

Machine learning includes neural networks and, as part of the latter, deep learning (DL). All are AI expressions or subsets (Figure 1).

AI is a field of study that refers to the creation, through the use of digital technologies, of systems capable of performing tasks for which human intelligence is deemed necessary.

Figure 1 – AI CLASSIFICATION



Source: Prepared by the authors adapted from Needham (2018).

### **AI CAPABILITIES**

Thanks to capabilities that surpass human performance in many respects – for example, for processing large volumes of data – AI has proven its usefulness in a number of fields. These capabilities enable not only better results, but also more efficient and faster processes, including reducing delays and response times; reducing costs; managing limited resources; performing repetitive and routine tasks; improving projections and forecasts; and executing time-consuming tasks, such as reviewing thousands of documents and reports to extract relevant content. Box 1 highlights five AI capabilities that can be targeted for specific purposes, according to the interests and roles of different types of organizations.



**Box 1 – AI CROSS-CUTTING CAPABILITIES**

**AUTOMATION**

AI has the ability to take automation to another level, allowing a high volume of repetitive, routine, and process optimization tasks to be performed automatically and without the need for human involvement.

**PRECISION**

If properly trained, AI algorithms can perform certain tasks with greater precision and accuracy than humans, primarily because their ability to process large volumes of data simultaneously and respond quickly exceeds any human capability.

**DETECTION**

AI algorithms can be very useful for tasks that require a high level of attention and acuity, such as detecting errors in systems or reports, or warning of fraud or information theft. In addition, AI has the ability to act logically (within the parameters for which it has been programmed), capturing details that would go unnoticed by humans.

**PREDICTION**

AI supports decision making in a variety of ways. One of them is reducing the time spent on data processing and analysis that, based on simulation and modeling techniques, can inform about trends and possible consequences of certain decisions. Likewise, through the use of AI, it is possible to make more accurate predictions, at lower cost and in a greater number of areas (medical diagnoses, credit moratoriums, insurance risks, transportation and logistics, etc.).

**PROCESS CONTROL AND OPTIMIZATION**

AI makes it possible to bring together different types of data from various sources to obtain an integrative view that allows to identify possible errors or adjustments in information or workflows and, accordingly, to take corrective measures, improving the efficiency of the systems.

Source: Prepared by the authors.

## Artificial Intelligence in the public sector

While the advantages of adopting AI systems are better documented in the private sector than in the public sector, the capabilities offered by this technology can also be leveraged by the latter on several fronts. In this case, three areas are highlighted that cover a large part of the government's responsibilities and organizations:

1. Improving the formulation, implementation, and evaluation of public policies.
2. Improving the design and delivery of services to citizens and enterprises.
3. Improving the internal management of state institutions.

In addition, the technology can be targeted to specific issues, such as health-care, public transportation, national defense, education, or the administration of justice.

## AI TO IMPROVE THE FORMULATION, IMPLEMENTATION, AND EVALUATION OF PUBLIC POLICIES

The opportunities generated by AI for public policies can be identified more easily by observing the stages of the policy cycle, a model that, despite its limitations, is the most widely disseminated and influential for its analysis and understanding. In simplified terms, the cycle includes four stages: identification of the problem and its inclusion in the political agenda, design, implementation, and evaluation (Figure 2).

**Figure 2 - OPPORTUNITIES OFFERED BY AI IN THE DIFFERENT STAGES OF THE PUBLIC POLICY CYCLE**



Source: Prepared by the authors.

### IDENTIFICATION OF THE PROBLEM AND INCLUSION IN THE AGENDA

AI can help at this stage in two specific ways. The first is by identifying trends and anticipating emerging situations that merit the attention and intervention of public organizations, both to address them in the short term and to prevent future complications. This information allows governments to be better prepared and to act more proactively.

The second way is by capturing and analyzing the interests and concerns of citizens or different interest groups, for example, those expressed in social networks or opinion polls. With the use of techniques such as natural language processing, it is possible to identify how citizens perceive or interpret certain events or their reactions to public administration measures or positions, which can facilitate an alignment between the government agenda and the needs and interests of the population.

### POLICY DESIGN

AI can contribute to directing policies towards individuals, enterprises, or territories in specific conditions or with more urgent needs. In this way, it avoids wasting resources and increases the probability of obtaining the expected results. It can, for example, be used to identify individuals at higher risk of dropping out of school or populations more vulnerable to certain diseases and, based on that, establish specific measures (Centre for Public Impact, 2017).

On the other hand, when choosing between different alternatives for public intervention, AI facilitates the comparison of possible results of each one of them according to changes in different variables, as well as the determination of the budget and resources required in each case. In this way, decision-makers will be able to choose the most appropriate options for the context and the specific interests of the organizations and governments.

#### **POLICY IMPLEMENTATION**

One of the areas where AI can have an impact on policy implementation is in communication with different audiences, understanding that not all segments of the population perceive policies in the same way. Tailoring the scope, type, and forms of interaction with the help of AI will serve to increase the likelihood of successful interventions (Centre for Public Impact, 2017).

The possibility of monitoring the implementation process in real time also makes it possible to modulate the intensity of policies in response to changes in the context. For example, data analysis with AI will facilitate the relaxation of measures to improve traffic conditions in cities at certain seasons or times, as well as to intensify controls on emissions of certain pollutants in urban areas.

#### **POLICY EVALUATION**

The greatest impact of AI in the policy evaluation stage in the short term will be the reduction of the time needed to carry out policy updates or adjustments, providing access to valuable information in real time to make decisions on the need to redirect, continue, or terminate programs or projects.

The possibility of considering and integrating information from multiple sources for more comprehensive and complete evaluations can also help provide better feedback processes, as well as strengthen the accountability of the organizations responsible for the policies.

#### **AI TO IMPROVE THE DESIGN AND DELIVERY OF SERVICES TO CITIZENS AND ENTERPRISES**

The opportunity to generate analyses and tools that favor a better understanding of the behavior of citizens or certain groups extends beyond the definition and prioritization of public problems to areas that have to do with the experience of access to services such as transportation, healthcare, education, security, or justice, or the way in which groups or citizens are affected by the actions of public organizations.

Thanks to the high penetration of mobile devices, social platforms, and the media, where individuals and organizations frequently express their positions, authorities have the possibility of obtaining relevant information about concrete situations experienced by citizens in their daily lives that may affect their well-being or reveal specific demands from certain stakeholders. This information is fundamental to adapt the design of services to the ways of thinking, feeling, and acting of individuals or organizations according to their realities, which is very useful, for example, to provide services and assistance to minorities or specific populations.

On the other hand, AI systems, such as chatbots, can make interactions with citizens more efficient, giving quick answers to specific questions or requests in their more basic or more sophisticated versions, which include machine learning, addressing more complex interactions. This ability to provide guidance and

This information is fundamental to adapt the design of services to the ways of thinking, feeling, and acting of individuals or organizations according to their realities, which is very useful, for example, to provide services and assistance to minorities or specific populations.

Perhaps the biggest challenge met by governments in the face of AI is finding a balance between exploiting a technology that will enable them to make a great leap forward (...) and setting limits on it to ensure social welfare.

answers in an agile manner makes it possible to improve citizen satisfaction levels with the performance of public organizations.

### **AI TO IMPROVE INTERNAL MANAGEMENT OF STATE INSTITUTIONS**

The opportunities offered by AI for the stages of the policy cycle or for the design and delivery of public services also extend to the operation and management of state organizations. This support is possible not only because it facilitates the achievement of their objectives and discharge of their responsibilities, but also because it allows them to do so while increasing efficiency and productivity levels.

AI systems can support the allocation and management of financial resources, helping to identify and prevent fraud and diversion or inefficiencies in the allocation and use of public money, among other problems. Likewise, the processing of requests, requirements, analyses, or decisions can be done more quickly, saving time for the organizations and their users. In the case of assets or infrastructure, it is possible to perform preventive maintenance, correct failures, or schedule their use according to demand through AI applications, achieving more efficient utilization (van Ooijen et al., 2019).

In particular, it is worth highlighting the possibility of substantially increasing the value added of public work. Given its ability to automate, AI can take on repetitive and routine human activities and decisions, empowering staff members engaged in these types of tasks to devote their time, knowledge, and capabilities to explore activities of greater value and complexity, where creativity, judgment, emotional skills, and human perspective are needed.

One way to advance in automation is to divide processes into stages or activities, in order to identify those that can be automated. For example, it is possible to automate data entry into a system through automatic handwriting recognition, voice recognition, or natural language processing to increase the speed and assertiveness of responses to citizen demands.

## Potential risks of Artificial Intelligence in the public sector

The expectations generated in recent years around AI, driven mainly by private sector investments and bets, have posed a challenge to governments. On the one hand, they must quickly generate policies and conditions to stimulate innovation while maintaining ethical boundaries; on the other hand, they are striving to understand the technology and not fall behind in its adoption.

Falling behind in this regard represents a risk for the public sector of being overtaken in its ability to act strategically and to respond quickly and efficiently to social needs. However, remaining cautious about the promises of AI may be the most sensible and productive position for governments to take in their quest for greater benefits (Machine Intelligence Research Institute [MIRI], n. d.).

Perhaps the biggest challenge met by governments in the face of AI is finding a balance between exploiting a technology that will enable them to make a great leap forward on the fronts described above and setting limits on it to ensure social welfare. In order to move forward in this direction, the public sector must pay special attention to the following aspects.

## **PRIVACY AND CONFIDENTIALITY**

Privacy is the right of individuals to establish limits on the information that is disclosed about them, to not be observed, and to have their confidentiality maintained. In this sense, the growing volume of data generated by some and captured by others on a daily basis represents a risk for that right, especially because much of that capture is happening through devices and procedures that are neither known nor authorized by the owners of the data, such as cameras and sensors in public places, mobile phone applications, or social networks. Not knowing when data capture and processing is occurring, by whom, let alone for what purpose, strips citizens and organizations of the capacity to take a position on the matter.

As personal and collective data are the cornerstone of AI, their analysis, disclosure, use, and reuse may generate results or conclusions that the owners of the information do not want to be disclosed or used for certain purposes. For example, from the triangulation of information from the same person across different datasets, it is possible to identify their identity, health status, or political leanings. This information, when integrated into algorithms for automated decision making, can lead to their identification and, from there, to situations of discrimination, or expose behaviors of individuals or groups without their authorization.

In order to build trust, both in public institutions and in the technology itself, it is essential that people feel that they do not lose their right to privacy. For this reason, it is essential that governments ensure that the designed and implemented AI systems comply with the data protection rules and regulations in force in each country.

## **TRANSPARENCY AND EXPLAINABILITY**

The processing of large volumes of data by AI algorithms is complex and difficult for the human mind to understand. The more sophisticated the model used, the lower the chances of participation and understanding. This difficulty in understanding how and why an AI system generates a result or comes to a decision makes them a “black box,” whose contents are unknown even to its programmers (Stone et al., 2016).

When a decision made or informed by an AI system has implications for the lives of individuals or groups – for example, authorizing the parole of a prisoner, allocating public subsidies, or making medical diagnoses – the need to understand the reasons that generated it and, with that, to allow its refutation in case it is considered wrong or unjust, requires that the decision-making process be transparent and explainable, which is crucial to ensure public trust (Brookfield Institute, 2018).

In any case, it is not sufficient for the user organizations to disclose the algorithms used and their operational form. This information must be understandable to all stakeholders (programmers or designers, regulatory bodies, end users or those affected). No less important is that these stakeholders are informed in advance of the use of AI systems, their purpose, capabilities, and limitations. In the case of overly complex algorithms, the possibility of explaining them can be reinforced with traceability and auditing mechanisms and the disclosure of their scope (Berryhill et al., 2019).

In order to build trust, both in public institutions and in the technology itself, it is essential that people feel that they do not lose their right to privacy.

In short, addressing the risks generated by AI implies recognizing that it is part of broader social contexts and systems; therefore, cannot be conceived in isolation from the social actors and processes that surround it.

### **INCLUSION, EQUITY, OR REPRESENTATIVENESS**

AI algorithms may yield inaccurate or misleading results with the risk of leading to discrimination or exclusion. This can happen in several ways. One is because the data with which the algorithm has been trained (teaching patterns, trends, or correct answers) have biases, i.e., they exclude important information, reflect social prejudices that are introduced during collection or labeling, or are not representative and, therefore, not suitable for making generalizations. When this type of data is fed into an algorithm, its limitations extend throughout the lifecycle of the AI system, causing its predictions or decisions to maintain or reinforce those biases and thus amplify disparities or exclusionary situations existing in the real world. As a result, certain groups or individuals may be affected in their access to resources or services, the level of surveillance to which they are exposed, the way they are treated by the government, and even their ability to be taken into account in an environment that emphasizes technology (Brookfield Institute, 2018). In the latter case, the results of some systems may reaffirm or deepen the existing digital divide.

Another way to induce discriminatory or exclusionary results in AI systems is by the design of the algorithms. This design is carried out by humans with biases or prejudices, conscious and unconscious, which end up being integrated into the parameters that are defined to feed the system. In this case, the understanding of certain realities or the vision of the algorithm designer regarding the needs or characteristics of individuals or communities may lead to an emphasis on – or prioritization of – some variables over others (for example, skin color, educational level, socioeconomic status, or place of residence). Likewise, the interpretation of the results of an AI system will sometimes depend on the user's preconceived ideas, paradigms, and judgments.

Given the way in which ideas and values can influence AI systems, one of the biggest challenges for governments is to promote social agreements around these systems, their understanding, scope, or relevance to specific populations, as well as what is expected from AI.

### **SECURITY AND INTEGRITY**

Technically speaking, AI systems are developed using software and hardware, which do not always work correctly and can cause failures in these systems. Moreover, the errors generated in the algorithms by the biased data or models mentioned above, the lack of proper maintenance, their use in undesired situations, the violation of privacy, or the learning of unsafe behaviors once they have begun to operate, are additional factors that can compromise the security of users and the systems themselves (Brookfield Institute, 2018).

As AI algorithms increase the efficiency and capacity of many processes, they also introduce new vulnerabilities. Unlike current cybersecurity models, which focus on unauthorized access control, the weaknesses of AI are not just at the entry points to the system, but in its interactions with the real world. Both AI algorithms and the software and hardware that underlie them are error-prone and susceptible to manipulation. Failures of this type may pose serious risks to individuals, organizations, and countries.

In short, addressing the risks generated by AI implies recognizing that it is part of broader social contexts and systems; therefore, cannot be conceived in isolation from the social actors and processes that surround it. The exploitation and understanding of the technology, particularly by governments, cannot focus

only on the technical aspects. Thereby, it primarily involves considering social responses and attitudes, in order to maintain its responsibility to ensure respect for human rights and generate dialogues and agreements on what society expects from AI. Only in this way will it be possible to build the trust necessary to achieve its full adoption.

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## Interview II

### Data openness and governance in the public sector

Fernanda Campagnucci is the Executive Director of Open Knowledge Brasil, with a broad professional background in themes such as transparency, technology, and open government. In this interview, she addresses the importance of open government data, data literacy, and its governance for digital transformation in the public sector.

***Internet Sectoral Overview (I.S.O.)\_ Considering digital transformation in the public sector, how important is open government data? What are the best practices adopted by government organizations internationally?***

***Fernanda Campagnucci (F.C.)\_ Data openness should be considered one of the fundamental pillars of any digital transformation strategy, but often these policies are treated in a tightly separated manner, even handled by different government structures. Designing a policy of data openness is not some-***



Photo: P. R.

**Fernanda  
Campagnucci**  
Executive  
Director of Open  
Knowledge Brasil.

thing restricted to the issue of transparency, since it involves working with the entire data cycle and not only with its publication. It involves stages that go from planning and improving the collection of data to designing the most advanced forms of availability, such as API (Application Programming Interface), including the constant evaluation of the quality of this data.

By implementing a good open data policy, the same infrastructure serves both internal purposes, for the government's own use in its digital policies and services, and for external dissemination to all other public agencies and sectors of society. It is important to think of all this as part of the same referential framework of data governance because it also involves other key dimensions of digital transformation: digital security and personal data protection. In this way, transparency and privacy can be thought of from the very beginning of the design of new digital systems and services, by default. Another benefit of opening up data as part of the public sector's digital transformation is open innovation, because the offering of quality open data expands the possibilities to engage the private sector, academia, and civil society in finding and developing solutions to public problems. Thus, the public sector increases its capacity to create digital products. If, in addition to opening up data, agencies open up the source code of their systems and applications, they can also benefit from the collaboration of several technical communities. At the international level, some examples of successful experiences of digital strategies that have made this articulation of transparency, digitization, collaboration, and open source are the Government Digital Service (GDS) in the United Kingdom (UK), or the actions around the Digital Republic in France. There are also other experiences at the local level, such as in the city of Barcelona in Spain.

"(...) by opening up data and processes, public agents interact with the entire ecosystem and learn by coming into contact with new themes and practices. There is nothing more efficient than learning, from real projects, to solve day-to-day problems."

***I.S.O.\_ In your opinion, what steps can be taken to promote data literacy among public servants? What are the initiatives that currently exist and what are the barriers to their implementation?***

***F.C.\_*** The very implementation of an open government policy is a pedagogical process in itself, because by opening up data and processes, public agents interact with the entire ecosystem and learn by coming into contact with new themes and practices. There is nothing more efficient than learning, from real projects, to solve day-to-day problems.

Some experiences illustrate this idea well. In *Pátio Digital* (Digital Courtyard) – an open government initiative from the Municipal Department of Education of São Paulo, which I coordinated between 2017 and 2019 – undergraduate students conducted data workshops for public managers, more experienced managers conducted training for others to use open tools and databases, and a cooperation agreement with the third sector allowed the implementation of a whole new automated data pipeline, which is now maintained by the Department itself, to name a few cases.

When the Department opened up microdata for the first time, it was such a robust database that it required the use of statistical software or programming language, and few people knew how to handle it. Periodic meetings were held in *Pátio Digital*, and a researcher, the parent of a municipal school student, offered an open course on the R programming language to use this data. The room was overcrowded because managers from other city departments also showed up. In general, there is a lot of demand and interest, but a lack of opportunities.



Another interesting experience focused on training is the program *Agentes de Governo Aberto* (Agents of Open Government), also from the São Paulo local government, which I helped implement in 2015, when I was working at the Office of the Comptroller General. In this initiative, which has been continued by different administrations until today as part of the open government policy, public calls select proposals for workshops offered by the society itself, with the managers being part of the audience. More than 30 thousand people have already attended the training courses, and the project was recognized as a replicable government practice by the Organisation for Economic Co-operation and Development (OECD).

There are also good government schools all over Brazil that could be better used and integrated with society and the public problems. The National School of Public Administration (ENAP) has good initiatives in this direction. During the pandemic, to support the opening of data, Open Knowledge Brasil developed the course "*Publicadores de Dados: da gestão estratégica à abertura*" (Data publishers: from strategic management to openness),<sup>19</sup> which has already trained almost a thousand civil servants from all over the country. In the publication *Emergência dos dados* (Data emergency),<sup>20</sup> we systematized successful cases of openness during the COVID-19 crisis. Good practices in data governance involve continuous training.

***I.S.O.\_ Regarding the expansion of Artificial Intelligence (AI) in the public sector, how can the data governance agenda be advanced, especially in the Latin American and the Caribbean region?***

**F.C.\_** A common situation in the region is the absence of data governance frameworks, which impacts the way AI projects are introduced in the public sector for several reasons. I will mention three. First, since data is the main input of AI, and if there is no organization, you do not know the data and the potential it has. Second, data quality is a key determinant of getting good results from AI models, including the control of biases. Finally, because algorithmic transparency, a necessary condition for implementing ethical and legitimate AI models in the public sector, also demands data and processes openness.

As with digital transformation, data governance is also structuring for AI. For example, implementing data catalogs or inventories, a practice central to data governance in an organization, helps to know what data is available and its potential for applying AI models. Open Data Plans, another governance tool, can help prioritize the treatment of databases that will serve as inputs for such purposes. Impact reports, fundamental for personal data protection, are equally important for the ethical evaluation of the use of data in AI models. In addition, establishing data pipelines, which organize everything from the collection to the publication of data, helps with projects' sustainability as it ensures the availability and update of data sources. But the most important aspect of governance, in my opinion, is the involvement of more stakeholders in decision making. AI will be used for what purpose? What public problems are intended to be solved and for whom? Who participates in reviewing and evaluating the process?

"(...) algorithmic transparency, a necessary condition for implementing ethical and legitimate AI models in the public sector, also demands data and processes openness."

<sup>19</sup> Available at: <https://escoladedados.org/courses/publicadores-2022-1/>

<sup>20</sup> Available at: [https://ok.org.br/wp-content/uploads/2021/11/Ebook\\_EmergenciaDados\\_OKBR.pdf](https://ok.org.br/wp-content/uploads/2021/11/Ebook_EmergenciaDados_OKBR.pdf)

"(...) placing themselves in the role of consumers of proprietary solutions and private infrastructures, governments often do not have adequate access to the very data they produce or collect. This is why it is critical to implement open infrastructure policies."

A good example of this orientation towards solving public problems was *EmpatIA*, a public call organized by the Latin American Open Data Initiative (ILDA) with Centro Latam Digital (CLD), the International Development Research Centre (IRDC), and the Inter-American Development Bank (IDB), which focused on the use of AI for development (AI4D). Several projects were developed with the support of the program, such as the monitoring of air quality in Chile, the anonymization of processes in Argentina, the monitoring of public procurement in Paraguay and Colombia. We, from Open Knowledge Brasil, have participated with *Querido Diário* (Dear Official Gazette), a project that collects and processes text from municipal official gazettes – a mass of text that is intractable by humans and that can benefit from AI with natural language processing.

### ***I.S.O.\_ From a Global South perspective, how can governments address challenges which involve digital and data colonialism?***

**F.C.\_** The Global South faces a complicated situation in the technology race, with underfunded research and development policies and the flight of talent to the Global North. This is reflected at a local level, with governments finding it difficult to develop their own solutions because, among other reasons, they cannot attract talent and compete with the private sector.

This situation also causes a problem from the point of view of technological sovereignty: placing themselves in the role of consumers of proprietary solutions and private infrastructures, governments often do not have adequate access to the very data they produce or collect. This is why it is critical to implement open infrastructure policies. Even in partnership with the private sector, priority should be given to open standards that allow interoperability between systems and open-source contracts. In this way, more players can be involved and collaborate, besides not creating dependence on large suppliers with backward practices and being a measure of transparency that allows the optimization of resources between public agencies and the monitoring of the allocation of the investment.

We have a vibrant technology community in Brazil that can be engaged in and is happy to contribute to finding solutions to public problems, via technical cooperation or voluntary collaboration. As a civil society organization, we have developed open source projects, such as *Querido Diário*, that bring together hundreds of volunteers with high technical skills. This is a valuable resource. Why cannot governments do the same?

In Europe, for example, there is a campaign joined by hundreds of organizations and experts called “Public Money, Public Code,” which means: if the government invests in a certain technology, it should be considered public, a common good. The so-called Digital 9, or simply D-9<sup>21</sup> countries, bring together the world’s leading digital governments, located mostly in the Global North, with a declaration of principles that establishes open source, open government, and open standards, among others, as parameters for their cooperation. The countries of the Global South also need to establish similar commitments to overcome their challenges.

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<sup>21</sup> Group consisting of the following countries: Canada, Estonia, Israel, Mexico, New Zealand, Portugal, South Korea, United Kingdom, and Uruguay.

# Domain Report

## Domain registration dynamics in Brazil and around the world

The Regional Center for Studies on the Development of the Information Society (Cetic.br), department of the Brazilian Network Information Center (NIC.br), carries out monthly monitoring of the number of country code top-level domains (ccTLD) registered in countries that are part of the Organisation for Economic Co-operation and Development (OECD) and the G20.<sup>22</sup> Considering members from both blocs, the 20 nations with highest activity sum more than 89.66 million registrations. In November 2022, domains registered under .de (Germany) reached 17.41 million, followed by the United Kingdom (.uk), China (.cn), and Netherlands (.nl), with 9.76 million, 7.48 million and 6.28 million registrations, respectively. Brazil had 5.01 million registrations under .br, occupying 5th place on the list, as shown in Table 1.<sup>23</sup>

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<sup>22</sup> Group composed by the 19 largest economies in the world and the European Union. More information available at: <https://g20.org/>

<sup>23</sup> The table presents the number of ccTLD domains according to the indicated sources. The figures correspond to the record published by each country, considering members from the OECD and G20. For countries that do not provide official statistics supplied by the domain name registration authority, the figures were obtained from: <https://research.domaintools.com/statistics/tld-counts>. It is important to note that there are variations among the date of reference, although the most up-to-date data for each country is compiled. The comparative analysis for domain name performance should also consider the different management models for ccTLD registration. In addition, when observing rankings, it is important to consider the diversity of existing business models.

# /Internet Sectoral Overview

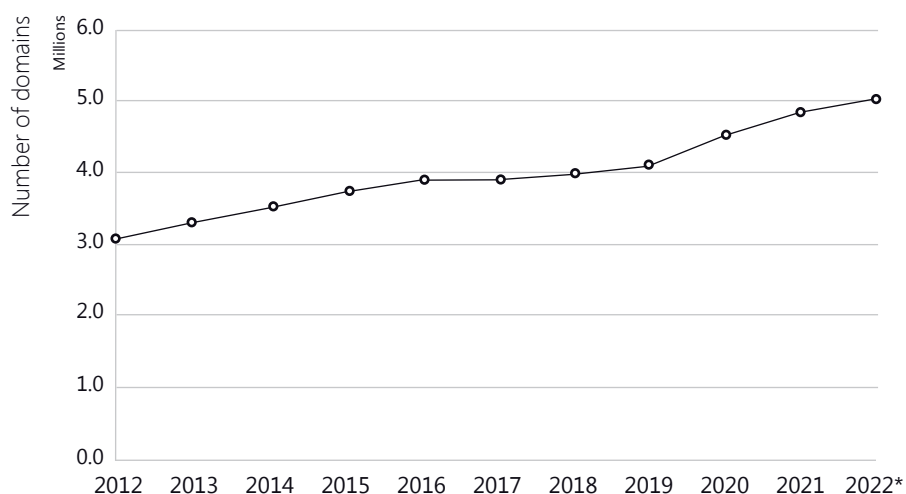
**Table 1 – TOTAL REGISTRATION OF DOMAIN NAMES AMONG OECD AND G20 COUNTRIES**

Position	Country	Number of domains	Date of reference	Source (website)
1	Germany (.de)	17,410,345	30/11/22	<a href="https://www.denic.de">https://www.denic.de</a>
2	United Kingdom (.uk)	9,760,758	31/10/22	<a href="https://www.nominet.uk/news/reports-statistics/uk-register-statistics-2022/">https://www.nominet.uk/news/reports-statistics/uk-register-statistics-2022/</a>
3	China (.cn)	7,488,332	30/11/22	<a href="https://research.domaintools.com/statistics/tld-counts/">https://research.domaintools.com/statistics/tld-counts/</a>
4	Netherlands (.nl)	6,286,992	30/11/22	<a href="https://api.sidn.nl/rest/counters/domains">https://api.sidn.nl/rest/counters/domains</a>
<b>5</b>	<b>Brazil (.br)</b>	<b>5,015,348</b>	<b>30/11/22</b>	<b><a href="https://registro.br/nicstats.json">https://registro.br/nicstats.json</a></b>
6	Russia (.ru)	4,953,926	30/11/22	<a href="https://cctld.ru">https://cctld.ru</a>
7	Australia (.au)	4,160,544	30/11/22	<a href="https://www.auda.org.au/">https://www.auda.org.au/</a>
8	France (.fr)	3,929,005	30/11/22	<a href="https://research.domaintools.com/statistics/tld-counts/">https://research.domaintools.com/statistics/tld-counts/</a>
9	European Union (.eu)	3,649,851	30/11/22	<a href="https://research.domaintools.com/statistics/tld-counts/">https://research.domaintools.com/statistics/tld-counts/</a>
10	Italy (.it)	3,471,536	30/11/22	<a href="http://nic.it">http://nic.it</a>
11	Colombia (.co)	3,431,265	30/11/22	<a href="https://research.domaintools.com/statistics/tld-counts/">https://research.domaintools.com/statistics/tld-counts/</a>
12	Canada (.ca)	3,327,086	30/11/22	<a href="https://www.cira.ca">https://www.cira.ca</a>
13	India (.in)	2,777,318	30/11/22	<a href="https://research.domaintools.com/statistics/tld-counts/">https://research.domaintools.com/statistics/tld-counts/</a>
14	Switzerland (.ch)	2,516,543	15/11/22	<a href="https://www.nic.ch/statistics/domains/">https://www.nic.ch/statistics/domains/</a>
15	Poland (.pl)	2,511,308	30/11/22	<a href="https://www.dns.pl/en/">https://www.dns.pl/en/</a>
16	Spain (.es)	2,000,397	13/11/22	<a href="https://www.dominios.es/dominios/en">https://www.dominios.es/dominios/en</a>
17	United States (.us)	1,891,080	30/11/22	<a href="https://research.domaintools.com/statistics/tld-counts/">https://research.domaintools.com/statistics/tld-counts/</a>
18	Belgium (.be)	1,750,001	30/11/22	<a href="https://www.dnsbelgium.be/en">https://www.dnsbelgium.be/en</a>
19	Japan (.jp)	1,715,549	01/11/22	<a href="https://jprs.co.jp/en/stat/">https://jprs.co.jp/en/stat/</a>
20	Portugal (.pt)	1,618,692	30/11/22	<a href="https://www.dns.pt/en/statistics/">https://www.dns.pt/en/statistics/</a>

Collection date: November 30, 2022.

Chart 1 shows the performance of .br since 2012.

**Chart 1 – TOTAL NUMBER OF DOMAIN REGISTRATIONS FOR .BR – 2012 to 2022\***



\*Collection date: November 30, 2022.

Source: Registro.br

Retrieved from: <https://registro.br/dominio/estatisticas/>

In November 2022, the five generic Top-Level Domains (gTLD) totaled more than 190.87 million registrations. With 159.37 million registrations, .com ranked first, as shown in Table 2.

**Table 2 – TOTAL NUMBER OF DOMAINS AMONG MAIN gTLD**

Position	gTLD	Number of domains
1	.com	159,373,986
2	.net	13,076,602
3	.org	10,680,422
4	.xyz	4,060,856
5	.info	3,681,604

Collection date: November 30, 2022.

Source: DomainTools.com

Retrieved from: [research.domaintools.com/statistics/tld-counts](https://research.domaintools.com/statistics/tld-counts)



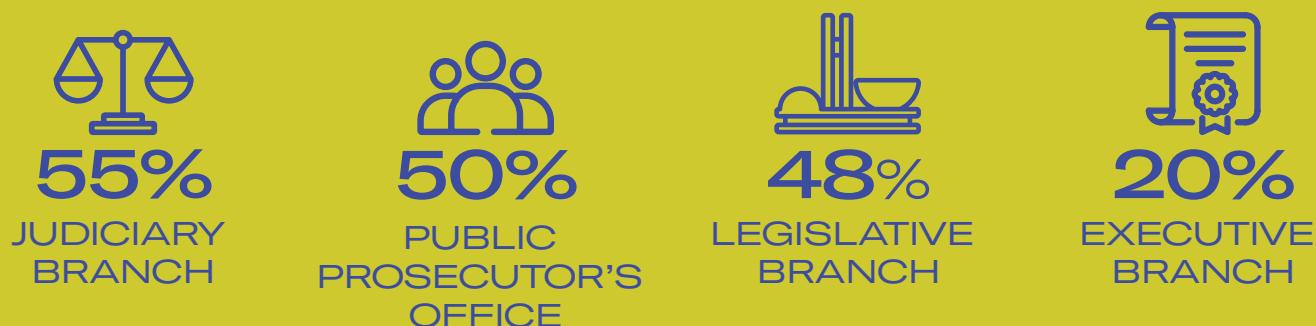
## USE OF ARTIFICIAL INTELLIGENCE IN THE BRAZILIAN PUBLIC SECTOR

Applications based on Artificial Intelligence (AI) have been spreading in the public sector. In Brazil, AI-based systems are part of the digital transformation initiatives in the government, enabling innovative solutions in public service delivery and internal management processes.

The following indicators<sup>24</sup> show the level of AI use by the Brazilian government organizations in 2021. Although there are differences in the use of these technologies by branch, the barriers to their adoption permeate structural and technological issues, both in federal and state government organizations.

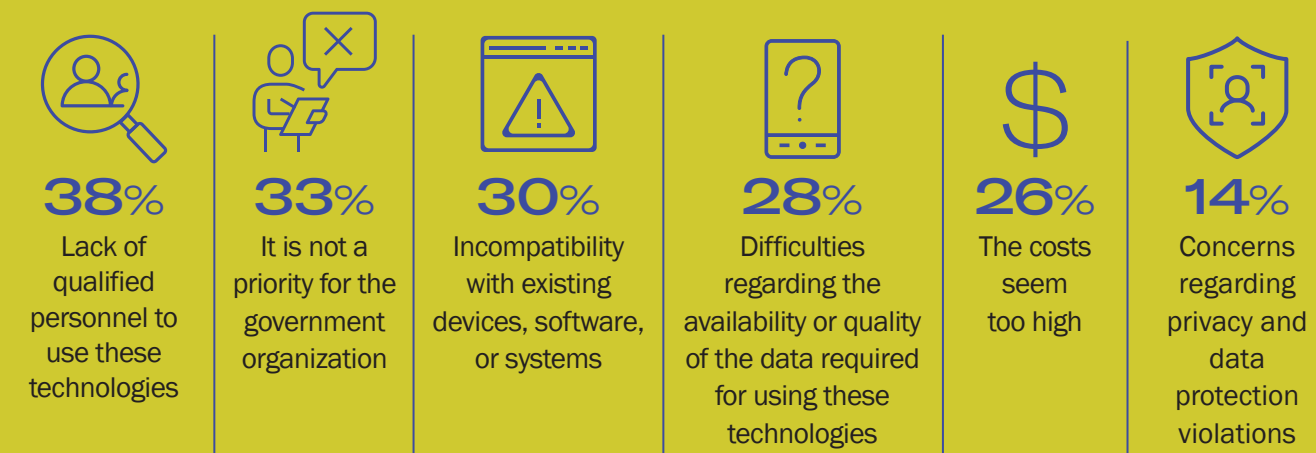
### WHAT IS THE PROPORTION OF GOVERNMENT ORGANIZATIONS THAT USE AI TECHNOLOGIES?

From the total number of federal and state government organizations (2021):



### AND WHAT ARE THE MAIN REASONS FOR NOT USING AI TECHNOLOGIES?

From the total number of federal and state government organizations (2021):



<sup>24</sup> Data from the ICT Electronic Government 2021 survey, from Cetic.br|NIC.br. Available at: <https://cetic.br/pt/pesquisa/governo-eletronico/>

# /Credits

## TEXT

### ARTICLE I

Manuela Maia Ribeiro,  
Javiera F. Medina Macaya,  
and Luciana Piazzon B. Lima  
(Cetic.br | NIC.br)

### ARTICLE II

María Isabel Vélez  
Mariutsi Alexandra Osorio-Sanabria  
Cristina Gómez Santamaría

### DOMAIN REPORT

Thiago Meireles (Cetic.br | NIC.br)

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Giuliano Galves and Maricy Rabelo  
(Comunicação | NIC.br)

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Ana Zuleika Pinheiro Machado  
and Robert Dinham

## EDITORIAL COORDINATION

Alexandre F. Barbosa, Javiera F. Medina  
Macaya, Luciana Piazzon B. Lima,  
Manuella Maia Ribeiro, and Tatiana  
Jereissati (Cetic.br | NIC.br)

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– Brazilian Office)  
Pablo Galíndez (CAF)  
Vitor Cipriano de Fazio ((011).lab)

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