

Technologies for public services

Inclusive digital government: Gender differences in access to online public services

By *Javiera F. Medina Macaya*,¹ *Manuella Maia
Ribeiro*,² and *Camila dos Reis Lima*³

The widespread adoption of technologies by society has been associated with a series of changes in the way people communicate and interact with other individuals and organizations. Among other transformations, digital government or electronic government (e-Gov) increases people's access to public services and information. Nevertheless, progress in digital inclusion is uneven both between countries and among different groups within society, mainly affecting the most

vulnerable and, consequently, their access to services and public policies through digital means is hindered (CGI.br, 2022).

One of these inequalities is related to gender differences in the adoption and use of technologies. According to the International Telecommunication Union (ITU), despite the diminishing differences in Internet access between men and women over the years, the gender digital divide still persists, especially in lower-middle-income and low-income countries (ITU, 2023). Thus, gender has been recognized as a relevant determinant of the digital divide (Mariscal et al., 2019), which goes far beyond just guaranteeing access to technologies such as the Internet.

In this context, a concept that has gained prominence for analyzing digital inclusion is the meaningful connectivity concept, which seeks a holistic understanding of the population's connectivity status. A study on the subject (NIC.br, 2024)

¹ PhD in Business Administration and Master's in Public Administration and Government from the São Paulo School of Business Administration at Fundação Getúlio Vargas (FGV EAESP), with a Bachelor's degree in Public Policy Management from the University of São Paulo (USP). She is a researcher in the Coordination of Qualitative Methods and Sectoral Studies at the Regional Center for Studies on the Development of the Information Society (Cetic.br) of the Brazilian Network Information Center (NIC.br), linked to Brazilian Internet Steering Committee (CGI.br).

² PhD and Master's in Public Administration and Government from FGV EAESP, with a Bachelor's degree in Public Policy Management from USP and a Law degree from Mackenzie Presbyterian University (UPM). She is a researcher at the Coordination of Research Projects at Cetic.br|NIC.br, where she leads the ICT Electronic Government and ICT Public Access Centers surveys.

³ Master's in Population, Territory, and Public Statistics from the National School of Statistical Sciences (ENCE) of the Brazilian Institute of Geography and Statistics (IBGE), with a Bachelor's degree in Statistics from the Federal University of Juiz de Fora (UFJF). She is a statistician at the Coordination of Quantitative Methods and Statistics at Cetic.br|NIC.br.

The survey revealed a gender divide in the use of e-Gov services, which may indicate barriers to accessing public services and information. This includes social policies in critical areas such as health, education, and social assistance, which are typically more sought after by vulnerable populations.

showed that although the proportion of female Internet users in Brazil (86%) is higher than that of males (83%), the proportion of men with better connectivity conditions is higher than that of women (Castello, 2024). According to the study, more precarious conditions of connectivity among women “exacerbate the pre-existing barriers to their productive inclusion, equalization of income, public incidence, and participation in the social, political, and economic life of the country” (Castello, 2024, p. 109). These disparities are not restricted solely to access to the Internet but can also manifest in online activities, thereby affecting access to the benefits and opportunities offered by the digital environment (Scheerder et al., 2017; van Deursen & Helsper, 2015). This includes gender inequalities in accessing digital government services (Macaya et al., 2021).

Thus, given the importance of implementing an inclusive digital government in which no one is left behind (United Nations Department of Economic and Social Affairs [UN DESA], 2022), this article aims to analyze the gender digital divide related to the use of online public services in Brazil. To this end, the study seeks to identify gender differences in the use of public services among Internet users, by using the results from the survey on the use of information and communication technologies (ICT) in Brazilian households, the ICT Households survey, with data collected in 2023 in Brazil (NIC.br, 2023). The survey revealed a gender divide in the use of e-Gov services, which may indicate barriers to accessing public services and information. This includes social policies in critical areas such as health, education, and social assistance, which are typically more sought after by vulnerable populations.

Digital government and digital divide

Although the term digital divide encompasses several definitions, it usually implies social and political inequalities related to the interactions between individuals, technology, and society (Helbig et al., 2009). Thus, although access to ICT is a prerequisite for citizens to access online public services and information, research increasingly considers social and environmental factors when defining the various dimensions that affect the use of digital government (Helbig et al., 2009).

Beyond perspectives solely based on Internet access as a way to measure digital inclusion, recent approaches have incorporated other dimensions, such as digital skills, usage patterns, and the tangible results perceived by connected individuals (Scheerder et al., 2017; van Deursen & Helsper, 2015). Research acknowledges that individuals have different experiences, outcomes, and benefits related to ICT, including access to public services (Macaya et al., 2021). In turn, these inequalities can impact possible improvements in the social and economic conditions of the population (Helbig et al., 2009; van Deursen & Helsper, 2015). Thus, digital divides not only hinder the use of digital government but can also establish new forms of exclusion (Bélanger & Carter, 2009).

The pursuit of gender equality in access to ICT, especially the Internet, is one of the pillars of the sustainable development agenda and national and international commitments supported by various countries and international

organizations, including the Sustainable Development Goals (SDG) (UN DESA, 2022). In this context, one of the gaps identified in the literature and in the debate on inclusive digital government, which aims to leave no one behind, concerns the disparities in Internet access and usage between men and women.

The disparities between women and men are perpetuated in digital access, creating challenges for governments in implementing digital services and information. This situation hinders vulnerable groups, including women, from fully accessing services and information through digital means. According to the E-Government Development Index (EGDI), measured by the United Nations (UN), few Member-countries offer electronic services specifically targeted towards women (UN DESA, 2022).

Factors such as gender, age, race, and income, among others, lead to systematic exclusions that limit the effectiveness of digital government policies for all people (UN DESA, 2022). Research on the adoption of e-Gov in some countries, such as India, Jordan, Pakistan, South Korea, and Turkey, have also revealed that men use these services more than women (Macaya et al., 2021). Analyzing data from Brazil before the COVID-19 pandemic, Macaya et al. (2021) identified greater use of online public services among men, also highlighting differences in the types of services and reasons why women do not use these digital services. However, despite the relevance of gender disaggregation, women are still underrepresented in the data collected: Few countries measure and make available indicators disaggregated by sex (UN DESA, 2022).

An exception to this context of data scarcity is the measurement of ICT use by the Brazilian population conducted by Cetic.br|NIC.br, which has been measuring Internet usage among households and individuals in Brazil since 2005 (NIC.br, n.d.). In addition to disclosing data disaggregated by various socioeconomic and sociodemographic variables, such as sex, income, race or color, and level of education, this survey collects data aimed at measuring the demand side of digital government in the country. Therefore, this paper analyzes the indicators of module G – Electronic government collected among Internet users aged 16 and over, focusing on the use of e-Gov services and public services sought or carried out online (NIC.br, 2023).

Use of online public services in Brazil

According to data from the ICT Households 2023 survey, 84% of Brazil's population are Internet users. Although the overall results show a small difference between women and men (86% and 83%, respectively), the picture of the digital gender gap takes on additional nuances when analyzed through the lens of meaningful connectivity (Castello, 2024).

The proportion of Internet users 16 years old or older who have used e-government services rose from 65% in 2012 (NIC.br, 2013) to 73% in 2023 (NIC.br, 2023). The results regarding the types of public services performed or for which Internet users sought information show that those related to labor rights, public health, personal documents, and government taxes and fees are the most commonly used, but only by approximately one-third of Internet users (Chart 1).

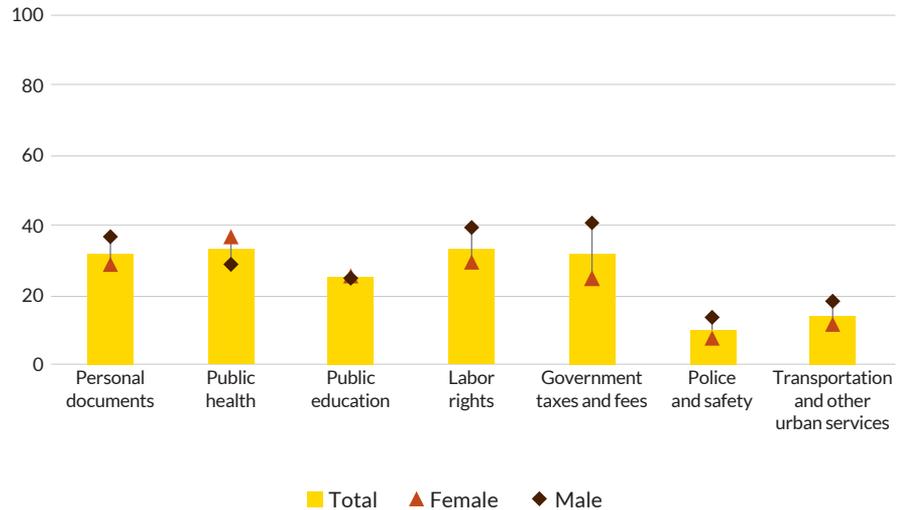
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/Internet Sectoral Overview

Services related to taxes and government fees, as well as labor rights or social welfare benefits are predominantly sought after by men in the various sociodemographic breakdowns published in the ICT Households survey, unlike those related to public health.

Chart 1 – INTERNET USERS, BY TYPE OF PUBLIC SERVICE INFORMATION SOUGHT OR USED IN THE LAST 12 MONTHS - TOTAL AND BY GENDER (2023)

Total Internet users 16 years old or older (%)



Source: NIC.br (2023).

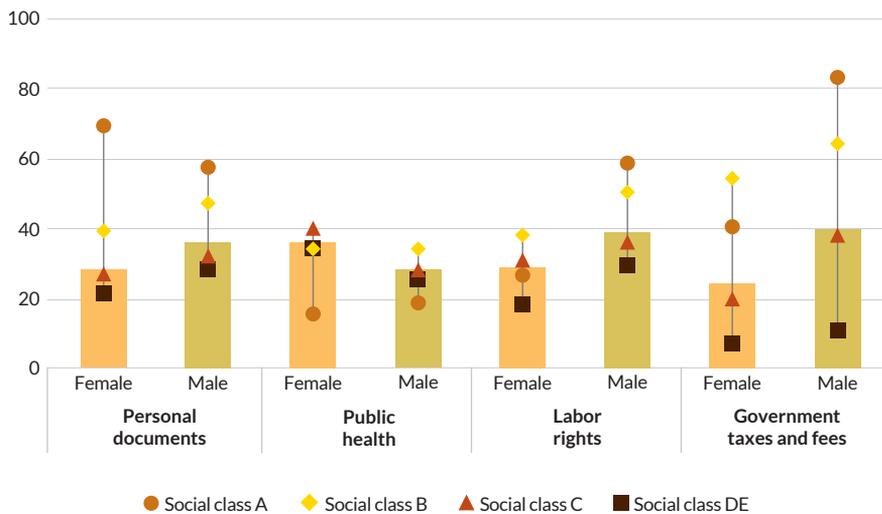
To identify e-Gov users in the country, the ICT Households survey investigates public services in which Internet users used or sought information entirely online. Among the seven types of services currently surveyed, those related to public health (such as scheduling appointments, requesting medications, or other public health system services) (33%), and services related to labor rights or social welfare benefits (33%) were the most cited, followed by personal documents (32%), and government taxes and fees (32%) (Chart 1). These services showed the most significant disparity between women and men: Government taxes and fees (24% and 40%, respectively); labor rights (29% and 39%); personal documents (28% and 36%); and public health (36% and 28%) (NIC.br, 2023).

Unlike services concerning public health, those related to taxes and government fees and labor rights or social welfare benefits are predominantly sought after by men in the various sociodemographic breakdowns published in the ICT Households survey. Regarding services related to government taxes and fees, for instance, there is a noticeable difference (43 percentage points) between women (40%) and men (83%) from social class A who sought information or used these services online (Chart 2). A difference of about 20 percentage points is also noted between Brown women and men (21% and 43%, respectively) and Black women and men (11% and 31%) (Chart 3). On the other hand, while discrepancies among women in categories of race or color and social class are marked (for instance, the proportion of White women who

reported using any service related to government taxes and fees was 35%, compared to 11% for Black women), this difference is only noticeable among men from different social classes. There is a 72-percentage-point difference between men in social class A (83%) and those in social classes DE (11%) who sought information or used these types of services (NIC.br, 2023).

Chart 2 – INTERNET USERS BY TYPE OF INFORMATION REGARDING PUBLIC SERVICES SOUGHT OR USED IN THE LAST 12 MONTHS - SEX AND SOCIAL CLASS (2023)

Total Internet users 16 years old or older (%)



Source: NIC.br, 2023.

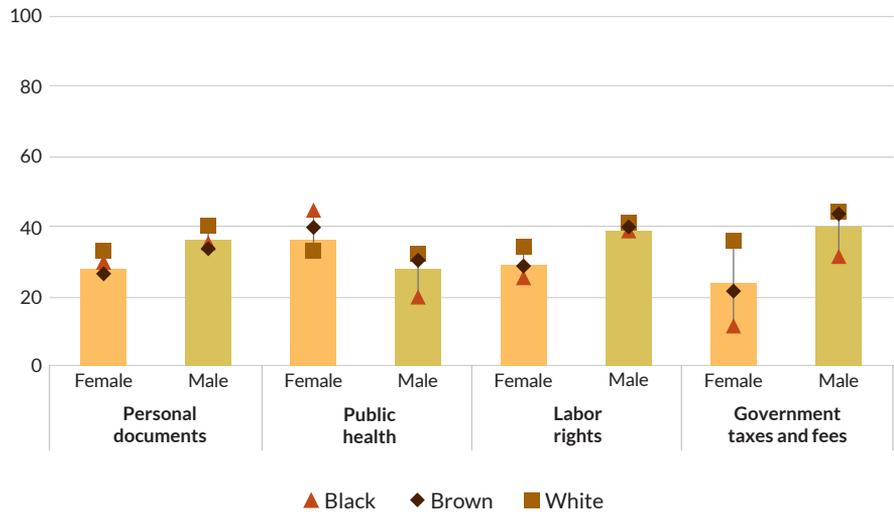
Public services related to public health show higher proportions among women in almost all investigated categories. The results show that Black and Brown women (44% and 39%, respectively) reported seeking information or using public health services in higher proportions than White women (32%). This difference is also evident when analyzing gender and social class: 15% of women in social class A reported seeking or using any public service in this area, compared to 39% and 34% of women in social classes C and DE, respectively. Despite the explanation that these differences may stem from greater reliance on services provided by the Unified Health System (Sistema Único de Saúde [SUS]), there is also a gender role difference in society: Except in social class A, more women than men declare seeking information or using public health services. This difference reaches 25 percentage points between Black women (44%) and Black men (19%).

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The results indicate that failing to understand the social and economic characteristics of the target population of public policies, especially beneficiaries and users of social policies, can transform digital government services into a new source of exclusion.

Chart 3 – INTERNET USERS BY TYPE OF INFORMATION REGARDING PUBLIC SERVICES SOUGHT OR USED IN THE LAST 12 MONTHS – SEX AND RACE AND COLOR (2023)

Total Internet users 16 years old or older (%)



Source: NIC.br (2023).

Final considerations

The data from the ICT Households survey analyzed in this article are important for better characterizing and outlining the complex landscape of digital divides. It discusses not only the use of e-government and gender inequalities but also those rooted on sociodemographic characteristics such as race or color and social class. The findings underscore the existence of various dimensions of exclusion that distinguish digital divides and digital government (Helbig et al., 2009), transcending the dichotomy of access/no access to the Internet.

While men and women in the country access the Internet in equal proportions, there are gender differences in accessing public services via the Internet, as well as differences based on race or color, age, educational level, and social class. These differences are present in the types of e-Gov information and/or services sought by Internet users. These gaps can mean that the opportunities offered by digital government are less utilized.

Therefore, in addition to demonstrating differences in access to online public services between men and women, the ICT Households survey also highlights disparities among women based on race or color, and social class, which has implications for the development of digital government in the country. Governments and public managers must consider disaggregated data when providing digital services, particularly those aiming at the most vulnerable populations. The results indicate that failing to understand the social and economic characteristics of the target population of public policies, especially beneficiaries and users of social policies, can transform digital government services into a new source of exclusion. Therefore, understanding the disparities

in access to public services via the Internet, such as those between men and women, is crucial for defining actions and strategies aimed at reducing these inequalities and ensuring access for those who need it. For future studies, it is important to delve deeper into the barriers that women face in accessing e-government services. This will enable the implementation of truly inclusive digital information and services for society as a whole, leaving no one behind.

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(...) understanding the disparities in access to public services via the Internet, such as those between men and women, is crucial for defining actions and strategies aimed at reducing these inequalities and ensuring access for those who need it.

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Interview I

Citizen-centered digital government

Luanna Roncaratti, from the Digital Government Secretariat (Secretaria de Governo Digital [SGD]), discusses the policies implemented by the Brazilian federal government for the use of technologies in the provision of public services with a focus on innovation and democratization of access.

Internet Sectoral Overview (I.S.O.)_ How have digital government strategies sought to ensure that marginalized groups are not further excluded through the use of technologies by governments? How can it be made possible for these groups to increasingly benefit from the opportunities arising from this use?

Luanna Roncaratti (L.R.)_ Leaving no one behind in the transformation of the State and the implementation of public policies is a fundamental guideline of the Brazilian Ministry of Management and Innovation in Public Services (Ministério da Gestão e da Inovação em Serviços Públicos [MGISP]). With this mission, the SGD coordinated the participatory drafting of the National Digital Government Strategy (Estratégia Nacional de Governo Digital [ENGD]), which was published in June. This strategy presents a set of recommendations for federal entities to plan and implement digital transformation actions in their governments. The Federal Digital Government Strategy (Estratégia Federal de Governo Digital [EFGD]) for the period 2024 to 2027, focusing on the work of the Federal Executive Branch, will also be published shortly. The two strategies are complementary, comply with the provisions of the Brazilian Digital Government Law (Law no. 14.129/2021⁴), and have as their basic principles the promotion of a more inclusive, effective, and people-centered State, which recognizes the multiple inequalities and barriers to access public services and proactively offers solutions that circumvent or solve these problems, providing a pleasant, simple, and agile experience.

⁴ Available at: https://www.planalto.gov.br/ccivil_03/_ato2019-2022/2021/lei/l14129.htm

Photo: Washington Costa



Luanna Roncaratti

Deputy Secretary for Digital Government at the Ministry of Management and Innovation in Public Services in Brazil (Ministério da Gestão e da Inovação em Serviços Públicos [MGISP]).

To expand the inclusion and adoption of digital government solutions, we also designed the Gov.br Desk (Balcão Gov.br) initiative. It is a partnership with state or municipal administrations to offer what is called “phygital,” i.e., integrated physical and digital channels to provide secure service to people who face difficulties in using digital channels. The initiative is currently in the pilot phase in 45 citizen service units: In Teresina (Piauí), Niterói (Rio de Janeiro), Lages (Santa Catarina), as well as in all the integrated call center units in Minas Gerais. The pilot began in March 2024, and, in just three months, more than 15,000 citizens have already been assisted. Soon, the initiative will be expanded to other states and municipalities.

Another initiative focused on improving and simplifying services is the Public Services Quality Laboratory (Laboratório de Qualidade dos Serviços Públicos [LabQ]), which consists of a set of services provided by a multidisciplinary team aimed at analyzing and researching the citizen experience. A wide range of methods and techniques, such as heuristic analysis, user journey mapping, interviews, and satisfaction assessments, are used to understand the user experience. It is therefore a systematized and structured way of listening to users and identifying their main pain points and difficulties. Based on this information, it is possible to implement improvements in services based on the reality and concrete needs of our population, aiming to expand access and use of digital government solutions.

I.S.O._ What are the benefits and challenges of thinking about digital government from a citizen-centered perspective? How does the Gov.br platform leverage these benefits?

L.R._ The digital government policy is one of the federal government’s priority agendas. Focusing on the people who need to interact with the State is one of the strategic pillars of the SGD and an important guideline of our Ministry. Our main goal is to promote inclusive digital public services that make people’s lives easier, leaving no one behind.

The Gov.br platform was designed to improve the experience of citizens and companies, as it unifies the government’s digital channels and tools. It enhances the benefits for citizens by combining a set of digital tools and services common to different bodies (login, electronic signature, notification, for example), which expands and improves people’s experience with digital public services. One of these tools is the Gov.br unified portal, which consolidates institutional information, news, and public services. In May 2024, 4,975 services were offered on this portal, 90% of which can be conducted completely digitally. The unified portal aims to provide a simpler and more complete service journey, and its main page shows the most accessed, recommended, and highlighted services. Services are also available by profile, such as “farmer,” “pensioner,” and “worker,” and by theme, such as “agriculture and livestock,” “social assistance,” and “science and technology.” SGD also provides the Gov.br account, which can be accessed through the logged-in area on the unified portal and the Gov.br application. There are 156 million people with accounts on the platform, who can request services,

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access documents or certificates, perform electronic signatures, and other features. It is important to note that the secretariat seeks to continually evolve its solutions and provide new tools that meet the needs of the population and simplify the user experience of digital public services. Currently, we are dedicated to advancing the implementation of a structuring solution for national civil identification, making documents and certificates available in a self-service format, and centralizing information on payments made between the citizens and the government.

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I.S.O._ What does the use of agile methodologies in the public sector entail? What role does it play in democratizing access to public services and in the digital transformation of governments?

L.R._ SGD is the central body of the Information Technology Resources Management System (Sistema de Administração dos Recursos de Tecnologia da Informação [SISP]), which comprises over 250 federal public institutions. Since 2015, the *Software project guide with agile methodology practices (Guia de projetos de software com práticas de métodos ágeis)*⁵ has been available to these institutions, presenting a set of actions to promote the use of the methodology, such as seminars, training sessions, and benchmarking. According to the latest self-assessment conducted by SGD with SISP, more than 80% of organizations adopt agile methodologies. Also in 2023, a model was established for the procurement of software development, maintenance, and support services, preferably through agile development (SGD/MGI Ordinance no. 750).⁶

In addition to defining regulations that promote the use of agile methodologies, SGD adopts these methodologies in its internal processes for managing, designing, and developing solutions, as well as implementing initiatives to support public organizations in the use of these methods. The Startup Gov.br program, designed to support and accelerate strategic and high-impact digital transformation projects, consists of offering technical support comprising technological tools, specialized human resources (multidisciplinary profiles), and methodological guidance for agile management of a specific project portfolio. By May of this year (2024), more than 36 projects have been supported, and 25 of them are being implemented. Among the supported projects are Digital FGTS (FGTS Digital), Participative Brazil (Brasil Participativo) platform (used for the 2024-2027 Pluriannual Plan [Plano Plurianual 2024-2027]), I am Gov.br (Sou Gov.br) (a human resource

⁵ Available at: https://www.gov.br/governodigital/pt-br/estrategias-e-governanca-digital/sisp/documentos/arquivos/guia_de_projetos_ageisv1.pdf

⁶ Available at: <https://www.gov.br/governodigital/pt-br/contratacoes-de-tic/portaria-sgd-mgi-no-750-de-20-de-marco-de-2023>

management solution for public servants), the digital evolution of the Single Registry (Cadastro Único), and the electronic prescription of medications for the Popular Drugstore (Farmácia Popular) program.

LabQ, which was mentioned previously, also relies on agile methods, using various techniques to support service managers in listening to and understanding the needs and difficulties users face throughout their service journeys. The work of multidisciplinary teams in short-term projects on rapidly improving solutions contributes to the evolution and updating of applications, with a focus on people and the promotion of inclusion and accessibility.

These initiatives have a direct impact on the provision and democratization of public services, allowing citizens and enterprises to benefit from digital solutions that are rapidly developed and made available. In addition, digital public services are continually being improved so that interactions become simpler and more convenient for those who need to exercise rights or fulfill duties.

I.S.O._ Considering the research conducted by the federal government with users of public services, what are the main findings about the needs and difficulties of the population when accessing the government's digital services?

L.R._ Promoting a user-centered digital government is one of the principles of the current Digital Government Strategy. In recent years, 160 different user experience analysis studies have been conducted, to identify the pain points and difficulties faced by citizens when interacting with public services. More than 3,000 people were interviewed using qualitative listening techniques such as usability tests, interviews, focus groups, and ethnographic research. The findings regarding users' difficulties in using digital services were divided into eight main categories. The first three are related to communication, including the difficulty of understanding the purpose of the service when its scope or rules are not clearly explained; the complex language used on digital channels, with excessively legal or technical messages; and the lack of channels to ask questions. A fourth complaint relates to costly services that require a lot from the citizen – lots of documents, information, consulting different systems, for example – or that put up barriers to access. An additional common complaint is the lack of feedback on their request or user contextualization throughout the journey. Finally, the sixth difficulty is related to services designed according to the internal organization of the Public Administration, generally reproducing the common silos of bureaucracy in service stages, and not meeting the user's needs. The last two problems identified were digital interfaces that were not very intuitive or user-friendly, and the pulverization of services in various digital solutions and applications. In addition to conducting qualitative research, SGD provides a quality model for public services, which contains methodologies and instruments for measuring user satisfaction, such as an Application Programming Interface (API) that can be integrated into public services so that users can evaluate and make suggestions for service improvement. More than 1,300 services are integrated into the evaluation and more than 26 million evaluations have

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already been conducted, resulting in an average score of 4.47 (on a five-point scale). A self-assessment of service quality is also available, through which managers can verify adherence to parameters defined by the government, which include digital consistency and the user experience throughout the journey.

It is important to emphasize that the data generated by the qualitative and quantitative surveys contributes to mapping and understanding the main difficulties and indicates ways of designing and implementing better and more inclusive digital solutions for the population.

Article II

Exploring urban innovation: Insights from Artificial Intelligence adoption in Brazilian cities

By Soumaya Ben Dhaou,⁷ Tupokigwe Isagah,⁸ and Larissa Magalhães⁹

Introduction

Cities worldwide experience a massive flux of people seeking better employment, reliable public services, and enhanced well-being. This rapid urbanization presents significant challenges for city governance, including climate change, poor land management, and limited provision of social services. In response, many cities are increasingly turning to technology, particularly AI, to address this issue. AI offers innovative solutions to a wide range of urban challenges, from optimizing public transportation and managing waste to improving healthcare and ensuring public safety. This paper draws lessons from the experiences of Brazilian cities to explore the opportunities and challenges of implementing AI in urban settings.

⁷ Research specialist at the United Nations University Operating Unit on Policy-driven Electronic Government (UNU-EGOV), she investigates technologies such as Blockchain, Internet of Things (IoT), and data, leads the research line on digital transformation, innovation, and emerging technologies, and is committed to advancing digital governance and smart cities for sustainable and inclusive development, maintaining a strong focus on innovation and emerging technologies.

⁸ Research associate at UNU-EGOV, specializing in approaches for facilitating the digital transformation process in the public sector for social good, she explores techniques for the responsible adoption and use of Artificial Intelligence (AI) in African governments and was the key researcher of the Global Assessment of Responsible AI in Cities, being responsible for exploring plans and usage in cities and proposing policy recommendations for responsible design and use of AI in urban areas.

⁹ Research associate at UNU-EGOV since 2022. Her research interest includes government technology and innovation, focusing on open data, smart cities, digital transformation capabilities, and strategies.

AI holds significant potential to enhance public services and foster sustainable growth. For instance, it can improve the provision of health services (Secinaro et al., 2021) and ensure timely response to citizens' needs (Androutsopoulou et al., 2019). Additionally, this technology can monitor urban growth and climate change (MacArthur et al., 2022), contributing to the development of resilient and sustainable cities.

Despite the opportunities, significant challenges still persist. The digital divide can widen as AI may inadvertently discriminate against specific groups, making partial judgments due to inadequate data representation (Janssen & Kuk, 2016; Wakunuma et al., 2022). Privacy violations and data misuse arise when personal data is used for tailored services, and ethical concerns emerge as AI systems fail to uphold societal values and Human Rights. Many cities lack standards and regulations for planning, designing, and utilizing AI solutions (Isagah & Dhaou, 2023), an issue compounded by limited expertise and infrastructure, particularly in the Global South (Distor et al., 2023). Addressing these challenges is imperative before widespread AI adoption, ensuring responsible practices that effectively promote resilient, inclusive, and sustainable cities.

This paper examines the “responsible” adoption, implementation, and governance of AI in Brazilian cities. It explores the inherent risks and challenges while highlighting the pivotal role of AI in promoting resilient, inclusive, and sustainable cities. Based on interviews conducted, our exploration draws insights from the cities of Niterói (Rio de Janeiro) and Belo Horizonte (Minas Gerais) to provide key considerations for fostering responsible AI adoption in the context of Brazilian cities, specifying actionable strategies to align AI initiatives with the Sustainable Development Goals (SDG) (United Nations [UN], n.d.).

AI in Brazil

According to the *Government AI readiness index report*, Brazil is leading in the region of Latin America and the Caribbean in fostering innovation of this technology, integrating it into public service, and establishing governance mechanisms (Oxford Insights, 2023). The country is also ranked 32 among 193 countries, demonstrating Brazil's achievements toward AI adoption globally. Several initiatives are in place to accelerate its adoption by the government, including the creation of knowledge about the technology through research and development, the introducing of standards such as legal frameworks and data governance initiatives, and allocating public funds to support the initiatives (Filgueiras, 2022). The government has also encouraged its use in national e-commerce to personalize and optimize commercial relationship (Filgueiras & Junquilho, 2023).

Furthermore, Brazil has developed the National Strategy for Artificial Intelligence¹⁰ (EBIA) launched in 2021 which outlines an institutional framework

Addressing these challenges is imperative before widespread AI adoption, ensuring responsible practices that effectively promote resilient, inclusive, and sustainable cities.

¹⁰ Find out more: https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/transformacaodigital/arquivosinteligenciaartificial/ebia-summary_brazilian_4-979_2021.pdf

(...) Brazil has developed the National Strategy for Artificial Intelligence (EBIA) (...) which outlines an institutional framework underlining AI standards like its regulation, ethical framework, and proposing principles such as (a) inclusive growth, sustainable development, and well-being; (b) values centered on human beings and equity; (c) transparency and explainability; (d) robustness, security, and protection; and (e) accountability.

underlining AI standards like its regulation, ethical framework, and proposing principles such as (a) inclusive growth, sustainable development, and well-being; (b) values centered on human beings and equity; (c) transparency and explainability; (d) robustness, security, and protection; and (e) accountability. These principles aim to ensure a human-centered, inclusive, development-oriented, responsible, and ethical approach to AI, fundamentally improving people's lives and bridging the digital divide (Uechi & Moraes, 2023).

The strategy, however, has faced challenges in integrating existing policies for AI development, primarily due to a lack of stakeholder engagement in policy design and an undefined governance mechanism to engage various actors (Filgueiras & Junquilho, 2023). As a result, the document has had limited effectiveness.

OPPORTUNITIES OF AI IN BRAZILIAN CITIES

Brazil's adoption of AI in public sector operations marks a significant step towards innovative governance. By focusing on enhancing efficiency, transparency, and citizen engagement, AI technologies have transformed various aspects of public administration (Suarez, 2024). For instance, the government uses AI-driven satellite imaging and sensor data for real-time monitoring of deforestation activities, enabling faster responses to environmental threats, and aiding in the protection of the Amazon rainforest.

In Rio de Janeiro, AI-powered surveillance systems employing facial recognition and motion detection algorithms assist law enforcement in crime prevention and rapid response to public safety incidents. Furthermore, the city also utilizes AI to monitor and integrate public initiatives, mitigating event impacts using AI technologies that includes decision matrix algorithm. This algorithm incorporates variables such as mobility, weather conditions, extreme events, and citizen reports (Suarez, 2024). Similarly, the city of Manaus has deployed AI and automation technologies in a city hub to achieve real-time operational views for quicker responses to problems and emergencies. Additionally, available government platforms that generate public data provide an opportunity to transform the policy formulation and implementation process using AI (Filgueiras et al., 2019).

The Brazilian Amazon area uses AI to monitor roads, to better understand the impacts caused by landscape fragmentation, disasters like deforestation, and hazards, such as fire, to enhance forest conservation and regional planning (Botelho et al., 2022), which contributes to managing climate change and enhancing resilient communities. Additionally, AI can be used to monitor groundwater in Brazilian aquifers to manage water resources and availability in the country (Camacho et al., 2023). Again, such governance of water resources results in improved water availability and promotes equal access to basic services and needs within communities. Despite these advancements, some challenges such as data privacy and skills development persist.

CHALLENGES AND RISKS OF AI IN BRAZILIAN CITIES

Implementing AI in Brazil encounters significant challenges that impede the adoption process. One of the primary challenges is the lack of reliable and

robust databases to train algorithms. For example, AI applications in the Brazilian Amazon face difficulties due to limited data availability and diversity, which can lead to false road detection (Botelho et al., 2022); consequently, this results in inefficient AI models that may make unfair judgments and false decisions.

Existing policies do not provide concrete outcomes that favor AI implementation in the country (Figueiras & Junquillo, 2023). As there are no defined regulations in Brazil to regulate these systems, there is a pressing need for impact assessments to evaluate the risks associated with this technology solutions and take appropriate actions (Papp & Oliveira, 2023).

Furthermore, Brazil faces a significant digital divide, with disparities in digital and AI skills and infrastructure across different regions. Despite initiatives to alleviate these challenges, this divide remains a persistent issue. Many regions, especially rural and underserved areas, lack access to high-quality digital infrastructure, limiting their ability to leverage AI technologies effectively. The shortage of digital and AI skills is another critical challenge. Although there are efforts to enhance AI literacy and skills through various programs, the pace of skill development has not kept up with the rapid advancements of this technology, a gap that hinders the effective implementation and utilization of AI solutions in both public and private sectors.

Moreover, privacy concerns and data security issues are significant risks associated with AI implementation. The use of personal data for services based on this technology raises concerns about data misuse and privacy violations, particularly with the important adoption of surveillance and facial recognition in major cities (Carvalho & Powell, 2024). In this regard, ensuring that these systems respect societal values and Human Rights is essential to gaining public trust and acceptance.

Ethical concerns also emerge as AI systems may perpetuate existing biases and inequalities if not properly designed and monitored. Thus, the definition of the standards and regulations for planning, designing, and utilizing AI solutions will address the challenges and support the adoption process, which may facilitate the adoption of AI in cities in Brazil, such as the cases of Niterói and Belo Horizonte, presented in the next section.

This article is based on a study conducted using a mixed-method approach, which comprised a global survey, a systematic desk review, several case studies, and an Expert Group Meeting (EGM) (Dhaou et al., in press). First, a global survey was conducted to assess the AI landscape in cities, identifying challenges, opportunities, and gaps. This was complemented by a desk review, where diverse documents were analyzed to develop an analytic framework and compile a repository of 70 case studies, selected via purposeful sampling from 189 Member States to ensure global representation. Detailed case studies were then designed using a protocol to collect and analyze project-specific data, with follow-up interviews conducted for five cases to deepen insights. Finally, an EGM engaged over 100 participants from various organizations and academic institutions to validate the findings, gather feedback, and enrich the analysis, particularly focusing on gender and inclusion in the responsible implementation and governance of AI in cities.

Furthermore, Brazil faces a significant digital divide, with disparities in digital and AI skills and infrastructure across different regions. Despite initiatives to alleviate these challenges, this divide remains a persistent issue.

In 2022, Niterói launched its Digital Government Strategy (Estratégia de Governo Digital [EGD]) via municipal decree, aiming to implement data-driven public policies, foster a people-centered government, and expand digital public services. This strategy includes integrating related information technology (IT) and data management initiatives, setting the stage for future AI adoption.

Case studies from Brazilian cities

NITERÓI

Niterói is a city in Southeast Brazil with a population of around 550,000. At the forefront of digital transformation since 2013, the city's Niterói We Want 2013-2033 (Niterói que Queremos 2013-2033)¹¹ plan aims to enhance public service agility, efficiency, and transparency.¹² This strategy includes investments in technology infrastructure, improving service standards for citizens, qualifying public servants, and managing information and data effectively.

OPPORTUNITIES AND INNOVATIONS

Since 2021, Niterói has integrated unified digital services through the e-Niterói¹³ platform, evolving into a service portal that aligns with the National Digital Government Network (Rede Nacional de Governo Digital) (Gov.br Network [Rede Gov.br]). This integration allows local service users to utilize the federal government's unified login, streamlining access to services. The city has also established the Niterói City Hall Innovation Laboratory (Laboratório de Inovação da Prefeitura de Niterói [LabNit])¹⁴ and the School of Government and Management (Escola de Governo e Gestão [EGG])¹⁵ to foster technological innovation and management excellence.

In 2022, Niterói launched its Digital Government Strategy (Estratégia de Governo Digital [EGD])¹⁶ via municipal decree, aiming to implement data-driven public policies, foster a people-centered government, and expand digital public services. This strategy includes integrating related information technology (IT) and data management initiatives, setting the stage for future AI adoption.¹⁷

The municipality recognizes the potential of this technology to reduce operational costs, streamline processes, enhance personalized interactions between the government and citizens, support climate emergency responses, and improve long-term disaster management and urban planning. Consequently, these initiatives contribute to the city's goals of becoming inclusive, resilient, and sustainable.

PILOT AI PROJECTS AND EXTERNAL COLLABORATIONS

Niterói explores AI applications in various sectors. The Integrated Public Security Center (Centro Integrado de Segurança Pública [Cisp])¹⁸ is a key project that uses this technology for security purposes, employing intelligence analysis and license plate recognition software to monitor roads and communities, thereby promoting safety and security.

¹¹ Find out more: <https://www.portalplanejamento.niteroi.rj.gov.br/plano.php>

¹² Available at: https://www.portalplanejamento.niteroi.rj.gov.br/assets/docs/nqq/livro_niteroi_que_queremos.pdf

¹³ Find out more: <https://e.niteroi.rj.gov.br/>

¹⁴ Find out more: <https://egg.seplag.niteroi.rj.gov.br/labnit/>

¹⁵ Find out more: <https://egg.seplag.niteroi.rj.gov.br/>

¹⁶ Find out more: <https://www.governodigital.niteroi.rj.gov.br/egd/>

¹⁷ Available at: <https://governodigital.niteroi.rj.gov.br/wp-content/uploads/2023/03/13.pdf>

¹⁸ Find out more: <https://niteroi.rj.gov.br/tag/cisp/>

Furthermore, private companies are offering AI solutions to local administrations, covering areas such as public policy decision-making, public safety, urban planning, and public service information. While these applications are in the pilot phase, they demonstrate the city's commitment to leveraging this technology for urban innovation.

Niterói faces several challenges during its AI adoption journey. Firstly, there is a general lack of knowledge about this technology and its potential benefits among city managers, leading to difficulties in identifying risks and opportunities associated with AI systems, a gap that can perpetuate biased systems and unfair outcomes. Secondly, there is no defined governance or compliance framework for responsible AI at the city level. Thirdly, the city lacks a legal framework to address this technology and personal data protection, and the operationalization of national governance and standards at the city level remains unclear. Compounding these issues is the lack of knowledge about AI applicability and trust in these systems, which impedes citizen adoption of solutions based on this technology. Finally, fourthly, the global assessment of AI in cities¹⁹ indicates that developing strategies and policies focused on this technology is a priority for the municipal government and that multiple actors, such as those from legal, public procurement, and information and communication technology management areas, must be involved; however, so far, action has yet to be taken, as the managers involved are just beginning to get involved with AI.

Despite these challenges, Niterói developed a robust AI ecosystem involving senior management, innovation centers, and startups as part of its partner network within this ecosystem. The municipal administration has the capacity for data management, interoperability, and IT resources, with integrated systems and data-sharing capabilities that support AI implementation.

Niterói's journey illustrates both the opportunities and challenges of adopting this technology in urban settings, as the city's proactive digital transformation strategy sets a strong foundation for its integration, demonstrating its potential benefits in enhancing public services, safety, and governance. However, addressing knowledge gaps, building robust organizational and legal frameworks, and fostering citizen trust is critical for successful AI adoption. In this regard, Niterói's experience provides valuable insights and lessons for smaller and medium-sized cities aiming to leverage AI for urban innovation and sustainability.

BELO HORIZONTE

Belo Horizonte, one of Brazil's largest cities with around 2.3 million inhabitants, is recognized for its comprehensive digital transformation initiatives, which is part of the broader goal to become a smart city, marked by integrated services, systematic information management, and improved public administration efficiency (Carvalho et al., 2021). The city's action plan for 2022-2025, known as the Belo Horizonte Smart City Program,²⁰ focuses on sustainability;

(...) Niterói developed a robust AI ecosystem involving senior management, innovation centers, and startups as part of its partner network within this ecosystem.

¹⁹ The survey was carried out at the Secretariat of Planning, Budget, and Management Modernization of Niterói, Digital Government division in March 2024.

²⁰ Find out more: <https://prefeitura.pbh.gov.br/cidade-inteligente#:~:text=O%20BHCl%20acompanha%20todas%20as,na%20inclus%C3%A3o%2C%20redu%C3%A7%C3%A3o%20das%20desigualdades%20>

The survey conducted at Belo Horizonte city hall aimed to understand what technology can do for the city as managers begin to get involved in AI projects. Therefore, developing strategies and policies related to this technology is recognized as necessary for municipal management, although measures still need to be taken.

environment and well-being; mobility and security; governance citizenship, and citizen services; economic development and urbanism, and technological culture and digital inclusion (Prefeitura Belo Horizonte, 2023).

OPPORTUNITIES AND INNOVATIONS

Belo Horizonte has been proactive in improving its technological infrastructure and positioning itself as a smart tourist destination. Efforts to reduce bureaucracy, invest in mobility technologies, and promote digital inclusion have been central to the city's strategy, which recognizes the potential of AI to reduce costs, automate processes, and leverage available data for better decision-making and service delivery.

The survey conducted at Belo Horizonte city hall aimed to understand what technology can do for the city as managers begin to get involved in AI projects.²¹ Therefore, developing strategies and policies related to this technology is recognized as necessary for municipal management, although measures still need to be taken. Thus, AI applications and systems are being planned and motivated for implementation by the benefits that the technology may offer the city, such as cost reduction, key processes automation, and available data usage.

Key areas where AI is being applied include public safety, public service information provision, and public policy decision-making, aiming to enhance the city's ability to monitor growth, predict emergencies and weather events, detect fraud, and support planning and financial analysis. For example, the municipal prosecutor's office has developed and tested an AI system similar to ChatGPT to support legal teams, aiming to improve its efficiency. AI is also being used to assist tax authorities in analyzing grades and ensuring accurate service classification for taxation purposes. Additionally, AI-driven insights and risk alerts generated from municipal publications are evaluated by the municipal controller to support internal auditing.

From an operational standpoint, Belo Horizonte has implemented a modern video surveillance system associated with the Everyone's Center Program (*Centro de Todo Mundo*),²² which uses AI analytics to provide the city operations center with information, images, and alerts, supporting urban cleaning, inspection, mobility, and traffic management in the central region. These efforts contribute to the city's resilience, inclusion, and sustainability.

Despite the advancements, the capital of Minas Gerais faces significant challenges in adopting AI. Firstly, there is a general lack of understanding about this technology and its potential benefits among city managers, a knowledge gap that can hinder effective implementation and perpetuate biases within AI systems, leading to unfair outcomes, uncertainties surrounding responsibilities and skills, a misalignment between AI and Human Rights, and the risk of manipulation and abuse. Secondly, the city has yet to fully assess the costs associated with this technology implementation, which could result in inade-

²¹ The Computer and Information Technology Company of the Municipality of Belo Horizonte (Prodabel) and the Planning, Budget, and Management Secretariat (Secretaria de Planejamento, Orçamento e Gestão [SMPOG]) of Belo Horizonte participated in the research and granted the interview in November 2023 with recording consent. The systematized survey was applied in March 2024.

²² Find out more: <https://prefeitura.pbh.gov.br/governo/programa-requalificacao-centro>

quate budgeting and funding for responsible AI solutions. Thirdly, measures related to personal data protection, data quality, and data architecture are not clearly defined, a lack of clarity can lead to issues in maintaining the integrity and security of AI systems.

Within the project framework, latent concerns emerge regarding potential regulatory violations. During the transition from implementation to its maintenance phases, additional concerns arise, including privacy violations in data collection, transparency, and explainability issues, unaudited algorithms in procurement, system insecurity, potential social repercussions, and the risk of data embezzlement. Furthermore, the city lacks mechanisms to reduce dependency on AI vendors, making it difficult to audit and govern these solutions effectively. Concerns also persist regarding accountability, intellectual property, and ensuring that these technologies are citizen-centered. There is no established governance framework for responsible AI at the city level: The existing data protection guidelines at the federal level do not fully address issues of explainability and interpretability for public purchase of this technology, complicating the process of partnering with external developers. Finally, digital illiteracy among employees poses a significant challenge, addressed by the city, despite seminars and lectures being offered to develop AI-related skills and abilities.

Belo Horizonte's experience with AI adoption highlights both the opportunities and challenges associated with urban innovation. The city's proactive approach to digital transformation and AI integration demonstrates the potential benefits of AI in enhancing public services, safety, and governance. However, addressing knowledge gaps, establishing robust legal and regulatory frameworks, and building citizen trust are critical for the successful adoption of AI.

Therefore, the lessons learned from Belo Horizonte's journey provide valuable insights for other cities aiming to leverage AI for urban innovation. By addressing these challenges and fostering a supportive ecosystem for AI development, cities can unlock the full potential of AI to create inclusive, resilient, and sustainable urban environments

Lessons learned and recommendations

The case studies highlight the disparity in AI implementation between cities with different contextual backgrounds. Introducing these initiatives within city-level strategies, such as digital transformation or data strategy, is crucial for fostering AI awareness and readiness. Cities like Belo Horizonte, which have explicitly stated the use of data technology in their strategies, are better positioned to accelerate responsible AI adoption compared to cities like Niterói, where the absence of the acknowledgment of technology at the local level may hinder technological progression. Thus, it is recommended that cities define and articulate AI initiatives in their agendas to expedite responsible adoption of this technology.

Moreover, identifying and implementing AI capabilities at the city level is paramount for successful adoption. Belo Horizonte's defined capabilities under

(...) it is recommended that cities define and articulate AI initiatives in their agendas to expedite responsible adoption of this technology.

(...) by defining AI initiatives, establishing municipal-level capabilities, and implementing robust governance measures, cities can harness the transformative potential to foster inclusive, resilient, and sustainable urban development.

organizational, technological, and process levels have facilitated its integration into city services, emphasizing the importance of such groundwork. Therefore, cities should define their AI capabilities, including necessary competencies and resources, to effectively leverage them for urban development.

Furthermore, managing its ecosystem entails more than stakeholder inclusion. It requires effective partnership management to navigate potential conflicts related to data ownership, accountability, and system management. While such challenges may not be immediately apparent in cities like Niterói, which are in the early stages of its implementation, they become increasingly pertinent during the implementation and maintenance phases, as seen in Belo Horizonte. Even though the city has made strides in defining governance measures, more robust regulations are needed to comprehensively address the risks and challenges associated with AI adoption.

In conclusion, by defining AI initiatives, establishing municipal-level capabilities, and implementing robust governance measures, cities can harness the transformative potential to foster inclusive, resilient, and sustainable urban development. Thus, good governance is essential to ensure the sustainability of AI solutions.

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Interview II

Privacy, public services, and marginalized groups

Anita L. Allen, 'Henry R. Silverman' Professor of Law and Philosophy at the University of Pennsylvania, discusses the concepts of accountability and privacy, as well as Black Opticon, in relation to public services and government programmes.

Internet Sectoral Overview (I.S.O.)_ How do you see the relationship between the concepts of privacy and accountability within the context of citizen data protection in public services?

Anita L. Allen (A.A.)_ Whether one approaches the subject as a matter of ethics or as a matter of law, the relationship between privacy and accountability is important to explore in relation to claims about the rights and duties of privacy and data protection. My work has frequently and explicitly explored this relationship. Privacy and data protection encompass various norms or conditions of information access, data control, publication, observation, and decisions about intimacy and freedom of association. Privacy and data protection cannot be absolute without steeply compromising other worthwhile social values and needs. In one of my books, *Why privacy isn't everything* (2003), I argued that accountability – which I describe in detail as consisting of acts of (a) reporting, (b) explaining, (c) justifying, (d) submitting to sanctions, and (e) reliably submitting to surveillance – is no less a pervasive and commanding value than privacy. Yet it, too, must have social and political limits.

It seemed to me twenty years ago, and still seems to me today, that there was a technology-driven, reemergent trend toward accountability (even) for the intimacies of private life that requires caution and careful scrutiny. Although citizen data protection is worthy of the high value now accorded to it by regional and international schemes of Human Rights, accountability is a common requirement for access to public services. In most countries, health care services, and services for the poor or disabled people are provisioned by government to one extent or the other. The *quid pro quo* for receiving these services is a willingness to be highly accountable – to report personal and sensitive information, to be observed and surveilled whether in one's own home or state-controlled offices and residential facilities. In the United States, the poor are subjected to a degree of disclosure – and surveillance – accountability unimagined by the wealthy; yet, even the American wealthy people who frequently travel abroad by air will trade privacy for convenience, submitting, for example, to biometric identification in the nation's optional Global Entry System. In India, the Aadhaar card, a national identification card, is required by public services, and obtaining the card requires biometric iris

Photo: Sameer A. Khan



Anita L. Allen

"Henry R. Silverman"

Professor of Law and Professor of Philosophy at the University of Pennsylvania.

scans, fingerprints, and demographic information disclosures. The need for the card is not strictly limited to those who are poor and historically invisible to the State. The question then arises: When is accountability reasonable? The matter is open to debate. During the recent COVID-19 pandemic, we saw how the vaunted value of health information privacy gave way to arguments of social accountability. Governments and employers in the most liberal and democratic countries were empowered to access individuals' health information and mandate vaccines, masking, and quarantine.

I.S.O._ You have recently published an article in which you introduce the concept of Black Opticon. How does this concept contribute to the debate on privacy?

A.A._ The Black Opticon is a framing I introduced in my article in the Yale Law Review Forum²³ in 2022. It is a succinct way to refer to three characteristic ways in which Black people experience discrimination and other disadvantages online. I focused on Black people in the United States, not because I think we are more important or more unique than any other group, but because it is my own group – and I know the group well –, as they are among those subjected to extremes of enslavement and involuntary segregation. First, Black people in the United States today experience discriminatory over-surveillance. This is the “panoptic” problem of being watched, not in order to better deliver beneficial goods and services merited by human personhood or citizenship, but in order to detect presumed criminality and social deviance in furtherance of the carceral state, neo-colonialism, and other oppressions. Brazil has stronger national data protection laws than the United States. Yet it also faces difficulties with equitable privacy and data protection practices on the ground. Its Black and poor *favela* populations struggle with over-surveillance, in particular.

Second, Black people in the United States experience discriminatory exclusion. This is, borrowing from the French writer Didier Bigo, the “banoptic” problem of being shoved (due to racialized or caste status) outside of the bounds of civil society and disqualified from its social and commercial opportunities. Facebook is just one United States firm taken to task for exclusionary policies, limiting housing ads to able-bodied White people.

Third, as documented by our own Federal Trade Commission, Black people in the United States experience discriminatory predation. This I dub the “conoptic” problem that – and this is English slang – “con games” or “confidence games” are run on gullible, vulnerable populations, depriving them of their scarce financial resources with promises of enhanced status, education, and wealth.

It is no secret that privacy is not equitably distributed to societies' marginalized populations. We cannot assume that facially neutral and universal laws work equally well for all groups. I believe online data protection law and related public policy will have a better chance of achieving long-neglected

“Brazil has stronger national data protection laws than the United States. Yet it also faces difficulties with equitable privacy and data protection practices on the ground. Its Black and poor *favela* populations struggle with over-surveillance, in particular.”

²³ Find out more: https://law.yale.edu/sites/default/files/area/center/isp/documents/dismantling_the_black_opticon.pdf

“(…) there are problematic aspects. One aspect is the digital divide. This is a set of concerns about whether all groups of people, including those in remote and non-urban areas and those who are poor, have access to the education, hardware, software, and digital communications infrastructure they would need to reliably access online public services.”

equity goals if informed by the Black Opticon and equivalent frameworks (for example, the queer, indigenous, United States LatinX, and Asian communities), which enable us to closely hone in on what the law needs to do to deter and prohibit harm. In the article “Is privacy really a civil right?” that will appear in the Berkeley Law and Technology Journal (2024), Christopher Muhawe and I consider whether the trend toward characterizing privacy as a “civil right” can be expected to result in laws better able to tackle the Black Opticon and platform discrimination more generally.

I.S.O._ What are the key aspects of the current debate about privacy and marginalized social groups, especially regarding online public services?

A.A._ To some extent, and thanks to the best of Artificial Intelligence (AI), online public services will be more efficient for the government and more convenient for citizens and the public. The disabled and elderly can access services from home. The busy parent and/or professional can be spared mailing paper forms, waiting time on hold on the telephone, or standing in long queues. Yet, there are problematic aspects. One aspect is the digital divide. This is a set of concerns about whether all groups of people, including those in remote and non-urban areas and those who are poor, have access to the education, hardware, software, and digital communications infrastructure they would need to reliably access online public services. Should every home be provided with a computer? Should every mother have a smartphone? Can schools and libraries be staffed and repurposed with online public services in mind? And can privacy, confidentiality, anonymity, and data protection be afforded in such environments? The linguistic diversity problem is another aspect. In what languages are online services to be competently and reliably delivered? Having one or two common national languages does not erase the fact that in some cities, like New York, more than 100 languages are spoken. Reaching everyone is a problem offline, just as it is also a problem online.

I.S.O._ Is there a trade-off between online public services and citizens' privacy? How can we ensure that these services do not compromise the privacy of these people, particularly those most dependent on government social programs?

A.A._ Of course there are tradeoffs. The information that people must disclose in order to be served becomes data that can be stored, shared, analyzed, and used, all with privacy implications. We cannot “ensure” that online services do not compromise privacy. Good privacy and security laws can potentially reduce the risks of privacy harm for many users. But if those most dependent upon government social programs include the elderly, injured, disabled, and uneducated, there is a real problem. When we think of online transactions, we sometimes bring to mind as the paradigm user, a tech-savvy young adult accustomed to using digital platforms for school, shopping, socializing, ordering food, getting rides, accessing bus and train schedules, and so on. Such an idealized user acts independently, and their

worries about data protection are limited to the classic worries about hacking, and weak corporate data protection policies and security practices. But what of the non-paradigm, non-idealized online users? These individuals will need to sacrifice privacy to get the help they need from family and strangers to use government services platforms, because the platforms are not really set up to accommodate people who may be unaccustomed to recent online innovations or are slowed down by age, injury or disability and, consequently, mildly forgetful. To get help, the elderly or uneducated may need to share their passwords, credit cards, national ID or social security numbers, and medical histories. Ensuring that privacy isn't compromised for these populations is a great challenge. Societies might deploy technological innovation to reduce the need for vulnerable individuals to disclose information to third parties as an incident to accessing services; however, I fear the notion that vulnerable people unavoidably should be willing to sacrifice all their personal data is an under-examined bias.

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 G20.²⁴ Considering members from both blocs, the 20 nations with the highest activity sum more than 92.56 million registrations. In June 2024, domains registered under .de (Germany) reached 17.70 million, followed by the United Kingdom (.uk), China (.cn), and Netherlands (.nl), with 9.20 million, 8.57 million and 6.24 million registrations, respectively. Brazil had 5.35 million registrations under .br, occupying 6th place on the list, as shown in Table 1.²⁵

²⁴ Group composed by the 19 largest economies in the world and the European Union. More information available at: <https://g20.org/>

²⁵ 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

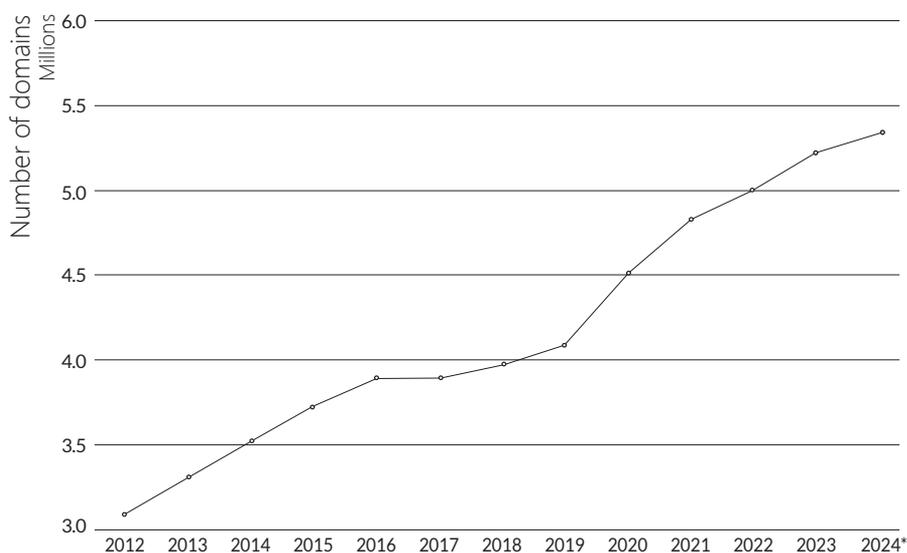
Table 1 – TOTAL REGISTRATION OF DOMAIN NAMES AMONG OECD AND G20 COUNTRIES

Position	Country	Number of domains	Date of reference	Source (website)
1	Germany (.de)	17,703,976	01/07/2024	https://www.denic.de
2	United Kingdom (.uk)	9,202,606	31/05/2024	https://www.nominet.uk/news/reports-statistics/uk-register-statistics-2024/
3	China (.cn)	8,579,046	01/07/2024	https://research.domaintools.com/statistics/tld-counts/
4	Netherlands (.nl)	6,244,660	01/07/2024	https://stats.sidnlabs.nl/en/registration.html
5	Russia (.ru)	5,685,419	01/07/2024	https://cctld.ru
6	Brazil (.br)	5,357,758	30/06/2024	https://registro.br/dominio/estatisticas/
7	Australia (.au)	4,249,654	01/07/2024	https://www.auda.org.au/
8	France (.fr)	4,138,319	12/01/2024	https://www.afnic.fr/en/observatory-and-resources/statistics/
9	European Union (.eu)	3,624,184	01/07/2024	https://research.domaintools.com/statistics/tld-counts/
10	Italy (.it)	3,492,138	30/06/2024	https://stats.nic.it/domain/growth
11	Canada (.ca)	3,388,264	01/07/2024	https://www.cira.ca
12	Colombia (.co)	3,271,336	01/07/2024	https://research.domaintools.com/statistics/tld-counts/
13	India (.in)	2,976,064	01/07/2024	https://research.domaintools.com/statistics/tld-counts/
14	Switzerland (.ch)	2,576,828	01/07/2024	https://www.dns.pl/en/
15	Spain (.es)	2,573,264	15/06/2024	https://www.nic.ch/statistics/domains/
16	Poland (.pl)	2,081,321	24/06/2024	https://www.dominios.es/dominios/en
17	United States (.us)	2,068,575	01/07/2024	https://research.domaintools.com/statistics/tld-counts/
18	Portugal (.pt)	1,856,643	01/07/2024	https://www.dns.pt/en/statistics/
19	Japan (.jp)	1,764,189	01/07/2024	https://jprs.co.jp/en/stat/
20	Belgium (.be)	1,727,276	01/07/2024	https://www.dnsbelgium.be/en

Collection date: July 1, 2024.

Chart 1 shows the performance of .br since 2012.

Chart 1 – TOTAL NUMBER OF DOMAIN REGISTRATIONS FOR .BR – 2012 to 2024*



*Collection date: July 1, 2024.

Source: Registro.br

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

In July 2024, the five generic Top-Level Domains (gTLD) totaled more than 189.87 million registrations. With 186.37 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	155,570,556
2	.net	12,753,229
3	.org	10,902,952
4	.xyz	3,595,406
5	.info	3,555,793

Collection date: July 1, 2024.

Source: DomainTools.com

Retrieved from: research.domaintools.com/statistics/tld-counts

Internet markers in Brazil

Indicators of the Internet Traffic Measurement System (SIMET)²⁶

The Center of Study and Research in Network Technology and Operations (Ceptro.br)²⁷, a department of the Brazilian Network Information Center (NIC.br), is responsible for SIMET, a tool used to assess the quality of the Internet. The tests, conducted by users in real-time, collect various metrics, including latency, jitter, packet loss, and download and upload speeds.

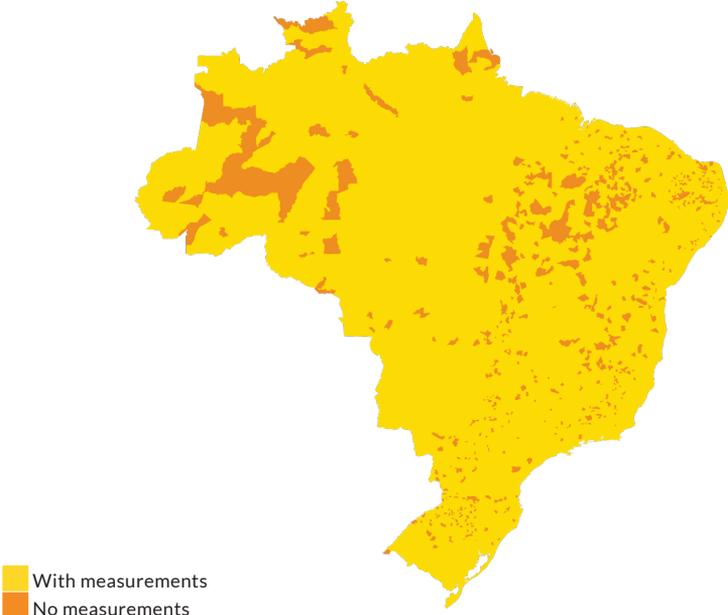
The advantage of using SIMET is how the quality of the Internet is measured. Based on a methodology that aims to ensure unbiased and neutral measurements, the tests are primarily performed outside the network of the Internet service provider (ISP) or operator, to collect data with the highest possible quality of information.

Measurements can be carried using the web (browser on any device with network access) or through the mobile (application available for mobile devices). Over the last six months, 911,159 measurements were conducted across both modalities. Figure 1 illustrates the extent of voluntary measurements using SIMET: Out of the 5,570 municipalities in Brazil (including the Federal District and the state district of Fernando de Noronha), 4,880 (88%) had at least one measurement recorded during this period, while Figure 2 shows the number of measurements conducted per municipality.

²⁶ Find out more: <https://medicoes.nic.br/>

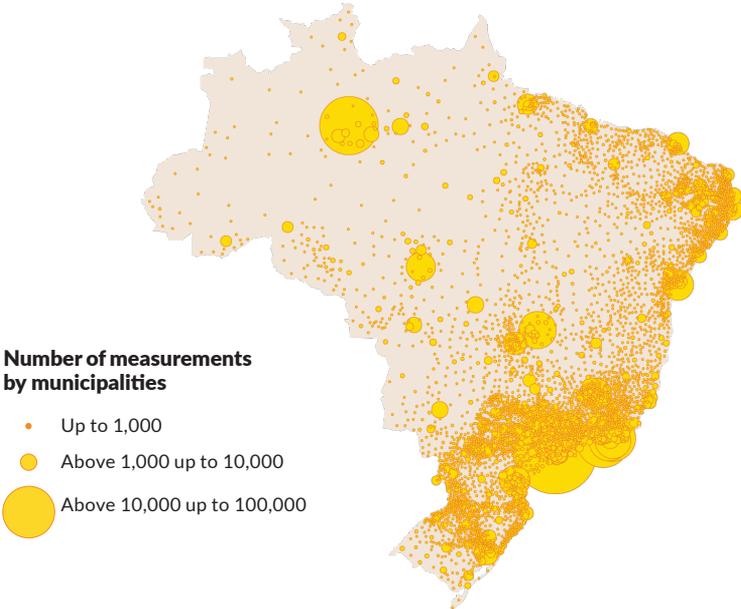
²⁷ Find out more: <https://ceptro.br/>

Figure 1 - MEASUREMENT RECORDING FROM WEB AND MOBILE METERS, BY MUNICIPALITY



Collection period: January 2024 to June 2024.
Source: Ceptro.br | NIC.br

Figure 2 - NUMBER OF WEB AND MOBILE METER MEASUREMENTS, BY MUNICIPALITY

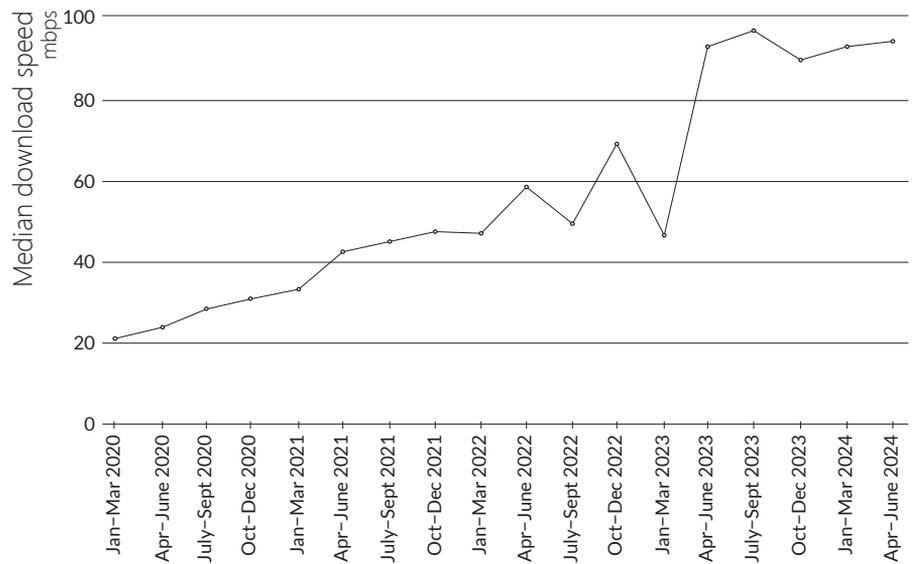


Collection Period: January 2024 to June 2024.
Source: Ceptro.br | NIC.br

/Internet Sectoral Overview

Download speed, one of the metrics for analyzing the quality of the Internet, refers to the data transmission rate or speed at which transactions take place between the measuring servers and the measured device. The higher the speed, the better the connection. Chart 1 presents the median of total download speed measurements per quarter since 2020, while Figure 3 shows the median download speed for the last six months for each Federation Unit (FU).

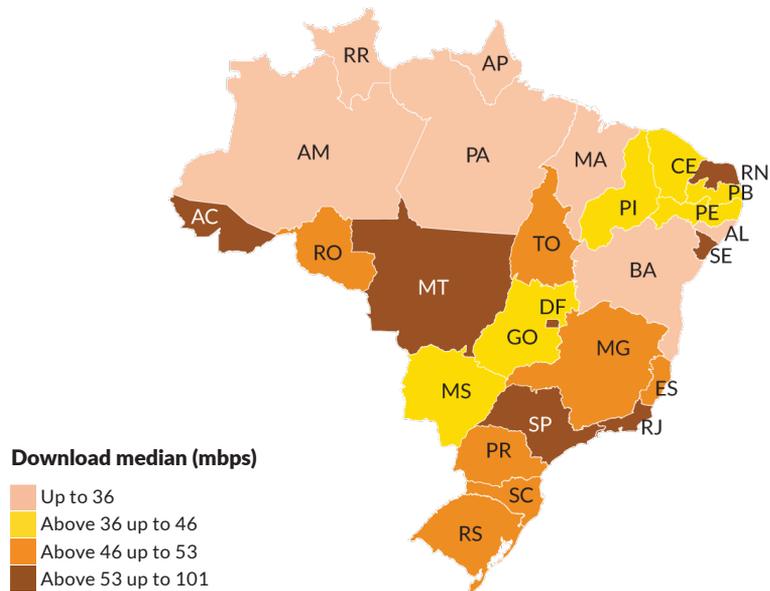
Chart 1 - DOWNLOAD SPEED MEDIAN, BY QUARTER - 2020 TO 2024²⁸



Collection date: July 1, 2024.
Source: Ceptro.br | NIC.br

²⁸ The fluctuations observed reflect existing variations in the proportion of measurements performed by mobile and web meters in each quarter. Despite this, there is a clear general trend toward an increase in download speed over time.

Figure 3 - DOWNLOAD SPEED MEDIAN, BY FEDERATIVE UNIT



Collection period: January 2024 to June 2024.
Source: Ceptro.br | NIC.br

Measurements are an essential subsidy to foster studies, generate analysis, and propose actions for a better Internet. The more measurements are taken in all Brazilian municipalities, the better the estimates of Internet quality will be.



Use SIMET meters!

Here you can find initiatives to measure, analyze, and improve the quality of the Internet in Brazil!

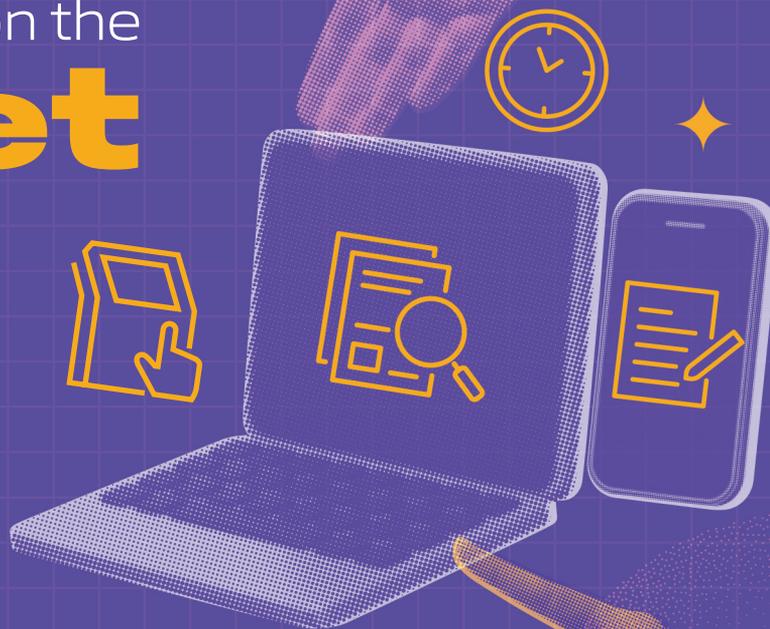


/Answers to your questions

Public services on the Internet

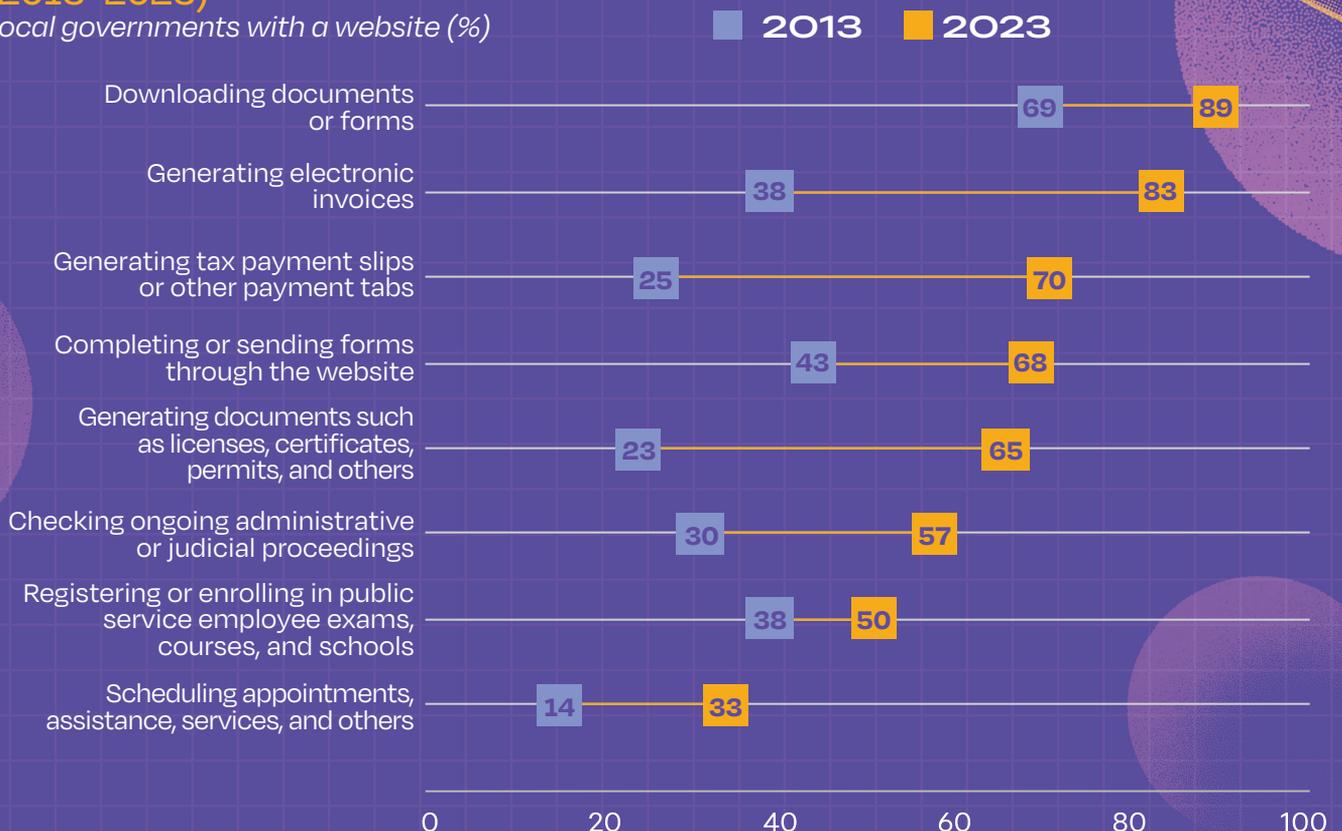
The use of technology to provide public services in Brazil is growing. The possibility of carrying out such services using the Internet enhances the State's capacity to serve citizens quickly and efficiently.

In 10 years, the proportion of local governments with a website has increased from 84% to 92%.²⁹ During this period, the types of services available on local government websites have also increased. Below are the results detailing the services provided by Brazilian local governments.



TYPE OF SERVICE MADE AVAILABLE ON THE WEBSITE (2013–2023)

Local governments with a website (%)



²⁹ Data from the ICT Electronic Government survey, by Cetic.br | NIC.br, available at: <https://cetic.br/en/pesquisa/governo-eletronico/>

/Credits

TEXT

DOMAIN REPORT

Thiago Meireles and João Claudio Miranda de Souza
(Cetic.br | NIC.br)

INTERNET MARKERS IN BRAZIL

Paulo Kuester, Solimary García, Cristiane Millan,
and Gabriela Marin (Ceptro.br | NIC.br)

GRAPHIC DESIGN

Giuliano Galves and Larissa Paschoal
(Comunicação | NIC.br)

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Ana Zuleika Pinheiro Machado

EDITORIAL COORDINATION

Alexandre F. Barbosa, Graziela Castello, Javiera
F. M. Macaya, and Mariana Galhardo Oliveira
(Cetic.br | NIC.br)

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and Tupokigwe Isagah (UNU EGOV)
Luanna Roncaratti (MGISP)

ABOUT CETIC.br

The Regional Center for Studies on the Development of the Information Society – Cetic.br (<https://www.cetic.br/en/>), a department of NIC.br, is responsible for producing studies and statistics on the access and use of the Internet in Brazil, disseminating analyzes and periodic information on the Internet development in the country. Cetic.br acts under the auspices of UNESCO.

ABOUT NIC.br

The Brazilian Network Information Center – NIC.br (<http://www.nic.br/about-nic-br/>) is a non-profit civil Entity in charge of operating the .br domain, distributing IP numbers, and registering Autonomous Systems in the country. It conducts initiatives and projects that bring benefits to the Internet infrastructure in Brazil.

ABOUT CGI.br

The Brazilian Internet Steering Committee – CGI.br (<https://cgi.br/about/>), responsible for establishing strategic guidelines related to the use and development of the Internet in Brazil, coordinates and integrates all Internet service initiatives in the country, promoting technical quality, innovation, and dissemination of the services offered.

*The ideas and opinions expressed in the texts of this publication are those of the respective authors and do not necessarily reflect those of NIC.br and CGI.br.



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