How can E-Government respond to the Digital Divide? Two Case Studies from Brazil.

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Abstract. This research explores how distinct municipal contexts in Brazil influence the design and implementation of digital public policies, focusing on two city-level digital initiatives. The study investigates the paradox of digital government efforts, which aim to enhance inclusivity and efficiency but often exacerbate the digital divide, particularly affecting underprivileged populations. This issue is significant for public administration, as understanding how local contexts shape policy outcomes is essential for creating inclusive and effective public services. Existing frameworks can fall short in addressing this puzzle because they often neglect the role of contextual variability and the necessary local adaptations to overcome digital exclusion. These frameworks overlook how sociotechnical factors specific to each locality impact user engagement and the success of digital policies. Building on this gap, we hypothesize that the adaptability of municipal governments to local demands and digital barriers is a decisive factor in user adherence and policy effectiveness. To address this question, we conducted a comparative analysis of two municipal digital initiatives: the "Ouvindo Nosso Bairro" participatory program in Salvador and the "Saúde Já Curitiba" digital health platform in Curitiba. These cases demonstrate how municipal governments have tackled digital barriers and tailored information and communication technology (ICT) solutions to meet the diverse needs of their populations. Our qualitative research design combines documentary analysis with interviews of program managers and participants. Fieldwork and primary data collection took place between October 2022 and January 2023. Using the digital divide lens, we analyze how local contexts influenced the development and outcomes of these initiatives. This study aims to contribute to the broader discourse on digital inclusivity by demonstrating how municipal governments can adapt public policies to bridge the digital divide. By offering insights into these adaptations, the research aligns with the Sustainable Development Goals, particularly those promoting inclusive and equitable societies, reducing inequalities, and fostering innovation in public administration.

Keywords. Digitalization, e-government, ICT, Digital Divide.
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1. Introduction

Following the global trend of government service digitization (Alston, 2018), Brazil has been implementing e-government initiatives at various levels of government and across different areas of social welfare. These initiatives are justified by claims that digital solutions promote greater efficiency, improved service delivery, transparency, and fraud prevention, among other benefits. However, these approaches transfer the responsibility to citizens, requiring them to independently access and manage social services through information and communication technologies (ICT) (Schou & Hjelholt, 2019).

At the same time, especially in developing countries, digital exclusion remains a persistent reality that reinforces existing social inequalities. In Brazil, according to data from CGI.br. (2024), approximately 84% of the population aged 10 or older accesses the internet, meaning that more than 34 million (16%) Brazilians still do not use it. Among internet users, 73% used e-government services. With the urgent need to reduce poverty and inequality in the current decade and the growing body of literature on the subject, it is possible to observe that these two contexts - the digitization of public services and digital exclusion - seemingly contradictory, demonstrate the need to fully understand the consequences of digital welfare, particularly for the disadvantaged, poor, and digitally excluded, who tend to be those who need the benefits that public policies can bring the most. Therefore, to create public services that fully meet the needs of users, it is crucial to map and understand the current state of the provision of these services, including interactions, information flows, and data among public sector organizations and the public's experience (Welby & Tan, 2022).

This research addresses the adaptability of digital public policies based on their context, recognizing the multiple factors that cause digital exclusion of the local population. The main question that guided this research is "How can digital public policies be designed to maximize citizen engagement and ensure equitable access to services, while addressing the digital divide and adapting to local socioeconomic and technological contexts?", followed by two secondary questions "How can municipal governments design digital services that effectively address the diverse needs of digitally excluded populations?" and "What are possible municipal goverment mechanisms for alleviating the digital divide and improving engagement in digtial policies?". To answer these research questions, this article presents two case studies of the digitalization of municipal policies to understand how ICTs can be adapted in the public sector, especially considering technologies accessible to citizens from different backgrounds. Furthermore, we believe this research can assist researchers and policymakers in crafting more digitally inclusive public policies, as both cases studied showed the ability to adapt to make them accessible to a wider range of users.

Our research aligns with the context of research on digital exclusion, which considers sociodemographic variables to have a significant impact on public policy discussions. Neglecting power structures, norms and social structures, culture, and access to resources can deepen the inequalities already experienced by vulnerable citizens, further hindering their individual, social, and economic development. Thus, it also aligns with some of the United Nations' Sustainable Development Goals (SDGs), "the current conceptualization of sustainable development encompass the wider discourse on how solutions to needs of society can be not only economically viable, but also environmentally bearable, and socially equitable at the same time" (Medaglia & Damsgaard, 2020, p. 2). Through the course of the research, the authors identified aligned topics in four of the SDGs: Goal 9 - Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation; Goal 10 - Reduce inequality within and among countries; Goal 11 - Make cities and human settlements inclusive, safe, resilient and sustainable; and with a primary focus on Goal 16 - Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels (UN Brazil, 2024).

2. Theoretical Background

2.1 E-Government

The field of e-government evolved from Information Technologies (IT) usage in government, related to internal data processing and the inner workings of governments, to the adoption of ICTs, related to external processes, service provisions, or connections among different actors involved in smart governance (Grönlund & Horan, 2005; Heeks, 2001). Moreover, e-government is a plural field composed of multiple areas of study, such as smart governance (Meijer & Bolívar, 2015; Meijer et al., 2016; Przeybilovicz & Cunha, 2024; Tomor et al., 2019), e-participation (Cardullo & Kitchin, 2024; Cunha et al., 2013; Figueiredo et al., 2023; Muñoz & Bolívar, 2021; Przeybilovicz et al., 2022) or the digital divide and digital exclusion (Macaya et al., 2021; Schou & Pors, 2019; van Deursen & Helsper, 2015). Also, there is a growing literature about public value generated by e-government, such as improvements in public services, administration efficiency, citizens' well-being, or public trust in government. However, there is little research on the public value of e-government policies in developing countries, and fewer are still in the least developed ones (Twizeyimana & Andersson, 2019).

Heeks (2001) defines the contributions of e-governance into three domains, improvements in governments' inner processes, improving connections with citizens and digital services, and connecting with different actors in civil society. Twizeyimana & Andersson (2019) rearranged these domains into E-administration, E-services and E-citizens and E-society, thus increasing the importance of E-services to stand as their own domain and joining together E-citizen and E-society as a single domain. Multiple factors influence the adoption and acceptance of e-government policies (Hofmann et al., 2012). Those factors are different when considering the multiple actors involved in e-governance, for instance, trust in government, the type of technology chosen, or digital proficiency could have a direct impact on the adoption of a digital policy by citizens. Moreover, policy digitalization has a deeper impact on the roles of the actors involved and the nature of their interaction. (Lindgren et al., 2019).

Citizen's interaction and communication with the government changed with the internet due to multiple new

channels and services that began to be offered online. More than that, services that once required mediation through public officials at specific places and during work-hour time, could now be scheduled directly by citizens at any time and any place (Lindgren et al., 2019). But there is a barrier in the form of the technological artifact itself, and its capacity to adapt to the local context, that may hinder or improve accessibility. Technological artifacts should cater to the digital excluded by having a lighter, more responsive, intuitive, and accessible interface. Those characteristics would also improve the overall perception of the artifact, even to those that are not technologically excluded (Baatiema et al., 2023; Catalina-García & Galera, 2003; Kim et al., 2023; Zhang et al., 2022). The identification of the local needs can be critical for increasing the adoption of the artifact. Failing to identify the local necessities and dynamics could prevent users from engaging with the technology, for instance, such as with the lack of physical devices by low-income families in Argentina (Kim et al., 2023) or the instructions not being translated to Spanish when addressing Hispanic families in rural California (Schwal, 2022).

2.2 Digital Divide

Academic interest in the theme of digital exclusion arose in the 1990s and is directly linked to the digitization of governments and the increase in the use of the internet and personal computers. Since then, the concept of digital exclusion has been evolving, as well as technology and its relationship with society. The inability to use digital solutions happens when e-services are designed with the digital interface as the default or main channel of interaction, and it affects citizens at different levels of the digital divide (van Deursen & Helsper, 2015; Schou & Pors, 2019). Initially, the focus of the studies was only on access to the Internet, but currently, it is understood that digital exclusion occurs at three levels (Scheerder et al., 2017).

The first level of the digital divide regarded people who did not have access or connection to the internet. As technology became more accessible, the second level of the digital divide became more apparent as well, as it was related to the individual's ability to use technology. People who had access to technology and a connection to the internet could still be excluded due to not possessing the skills to use them. The third level of the digital divide comprehends people who have access to technology and the skills they could still be excluded due to not knowing how to extract concrete benefits from the use of the internet (van Deursen & Helsper, 2015; Scheerder et al., 2017).

The digital divide affects demographics and socioeconomic extracts differently. Factors such as gender, income, age, race, and education influence the likelihood of an individual being excluded (Helsper, 2010; Macaya et al., 2021). Segments of the population that already suffer from socioeconomic exclusion are most susceptible to facing digital barriers when accessing online governmental services that are designed with the digital interface as the standard or the sole interface (digital-by-default). In such cases, digital governmental services, such as online welfare, could reproduce existing inequalities for already disenfranchised populations (Allmann & Radu, 2023; Buchert et al., 2023; Schou & Pors, 2019).

3. Methodology

To help answer our research question, two case studies were conducted on municipal digital governance initiatives in different Brazilian contexts; one focused on citizen participation and the other on digital health. The "Ouvindo Nosso Bairro" program, initiated by the Salvador city government, is a participatory budgeting program that began in 2015. In 2017, the program was digitized through an online interaction platform with citizens, changing its format. The other case, the "Saúde Já Curitiba" program, is the digital health initiative of the city of Curitiba, launched in 2017. The "Saúde Já" app underwent several changes, including operational system changes and adaptations to meet new demands, such as those generated by the COVID-19 pandemic.

The data collection consisted of collecting primary and secondary data. The data were gathered through documentary research and interviews with program managers and participants. The articles "O pesquisador conversador no cotidiano" (Spink, 2008) and "Institutional vulnerability and trust in public agencies: Views from both sides of the street" (Spink et al., 2021) served as guides for the work and interactions in the field. Field diaries were produced with comments, perceptions, and dialogues with different actors during the field immersions. The interviews followed a snowball method in which initial contacts pointed to the next contacts for interviews. This method creates a chain sampling based on referrals from the initial interviews (Patton, 2014). Below are the documents collected for each case:

Program	Primary data	Secondary data
Ouvindo Nosso Bairro Salvador	Semi-structured interviews with municipal managers and bureaucrats responsible for the program's implementation (7 interviewees in total). The interviews were conducted between October 2022 and January 2023.	Documents and official communications (18 documents from different sources), press releases, and articles about the program (5 documents from various sources).
	Semi-structured interviews with program participants and other citizens, such as local leaders, academics, and activists (14 interviewees in total). The interviews were conducted between October 2022 and January 2023.	
Saúde Já Curitiba	Semi-structured interviews with municipal managers and bureaucrats responsible for the program's implementation (5 interviewees in total). The interviews were conducted between November and December 2022.	Documents and official sources: Municipal Health Department, Municipal Council of Curitiba, Social Action Foundation, and Municipal Government of Curitiba.

Fig. 1 - Data collection for both programs. Created by the authors.

The data collection utilized in this research consisted of semi-structured interviews (primary data) and documentary research (secondary data). Data collection for both cases was approved by the Research Ethics Committee of FGV, the "Comitê de Conformidade em Pesquisas Envolvendo Seres Humanos" (CEPH). All research protocols followed meet the requirements of CEPH and adhere to research ethics. Audio recordings were transcribed, and key elements from the interviews were coded to analyze the data collected from them. The theoretical lens employed for data analysis of both cases was the Digital Divide. The field information is divided into a description of the two cases intertwined with quotes and excerpts from the data collection. In both cases, special attention was given to individuals at risk of being excluded from digital services, recognizing that the context and timing of digital programs can directly influence these citizens.

4. Case Studies

The case studies will be described chronologically. A timeline was created to compare both programs (Figure 2), and each case is described in its subsection.

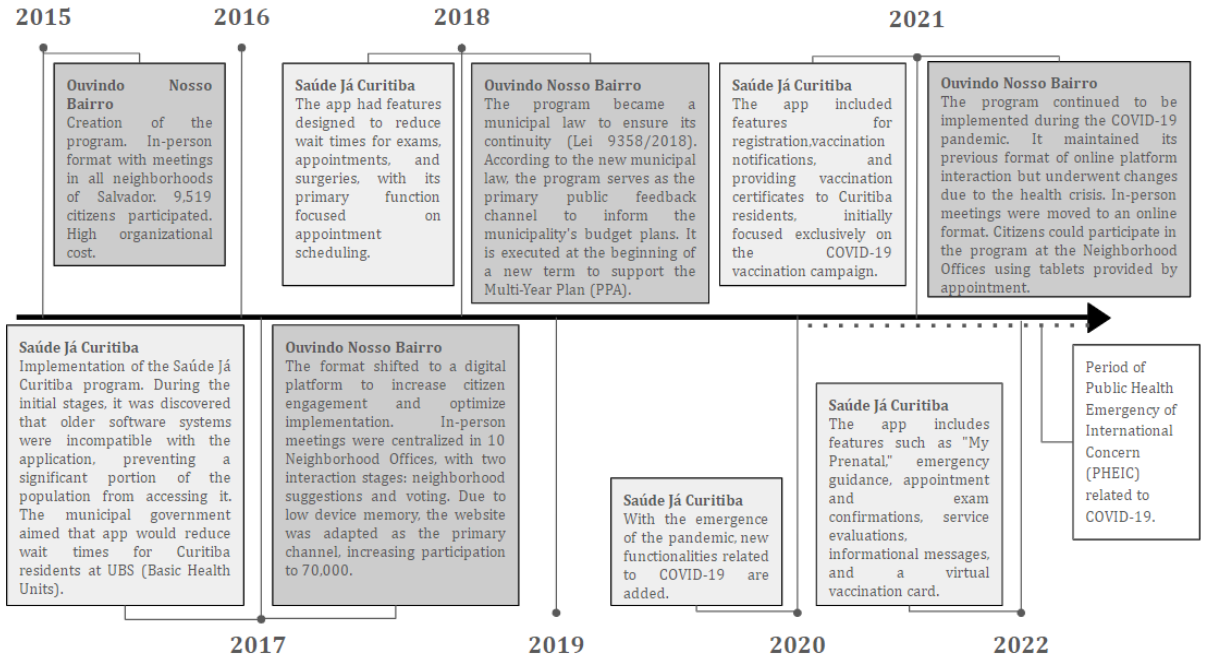

Fig. 2 - Comparative timeline of the Ouvindo Nosso Bairro and Saúde Já Curitiba programs. Created by the authors.

4.1 Ouvindo Nosso Bairro

The "Ouvindo Nosso Bairro" (ONB) policy was established in 2015 during a new management`s first term. The

implementation of the policy required significant political effort and was directly overseen by the mayor's office. The policy was an integral part of the administrative strategy to establish closer contact with the local population of Salvador. The first phase of the policy consisted of public hearings in each district of the city. Meetings were held at different times, on Wednesdays and Saturdays, in public places easily accessible to the local residents. In total, 152 meetings were held. (Matos et al., 2019; OGM - Ouvidoria Geral do Município, 2021). To ensure the continuity of the "Ouvindo Nosso Bairro" policy, it was passed as a municipal law by the city council, Law no. 9358/2018 This law requires the ONB to be conducted during the first year of a new municipal government term to substantiate the municipal budget plans (Gabinete do Prefeito Municipal do Salvador, 2018; Prefeitura Municipal do Salvador, 2021).

The second iteration of the policy took place during the administration's second term. This time, the administration brought a digitalization agenda and the ONB policy received a digital dimension through an online platform, created by the Companhia de Governança Eletrônica de Salvador (COGEL, literally translated as Electronic Governance Company of Salvador). This digital dimension aimed to increase the number of participants in the policy by centralizing participation in a smartphone application, and optimizing the implementation of the policy. The total number of participants increased from 9,519 participants to approximately 70,000. However, the policy lost part of its interaction. The face-to-face meetings held in each district were centralized at the ten subprefecture units (Matos et al., 2019).

The format of the "Ouvindo Nosso Bairro" changed due to its digitalization. The new format has four steps. The first step consists of citizens suggesting up to three infrastructure works for their neighborhood on the online platform. The results are then processed by the city hall and sent to the other secretariats, for technical and cost feasibility analyses. The approved results, based on the technical analysis, are returned to the citizens for voting on the online platform. At this step, citizens vote on their preferences from the approved list. After the voting is concluded, the results are published and the responsible secretariats start the most voted works for each neighborhood (Matos et al., 2019; Secretaria Geral de Articulação Comunitária e Prefeituras-Bairro, n.d.).

The administration took some precautionary measures regarding digital exclusion. The online process had the possibility of hybrid interaction and some key locations and public squares were equipped with free wifi connection for citizens. The hybrid policy worked with "Prefeituras-Bairro" units providing tablets and helping citizens participation. Also, city hall agents were positioned at high-traffic public places, equipped with tablets, to engage citizens to participate in the policy (Matos et al., 2019). After an initial test period, the administration found that the memory capacity of citizen's smartphones restricted the download of the application. So, the administration responded by modifying the ONB website to be more responsive, to accommodate all smartphones, and to become the main channel for interaction replacing the application. At the same time, a marketing campaign was launched aimed at informing citizens that the participation would take place through the policy's online webpage, as confirmed by interviewee 8:

Salvador is the city with most smartphones per habitants in the country (…) but, the idea of the application, was not a good idea. People had no memory on their cell phones, they used very simple cell phones, and that forced us to make a responsive system. Regardless of whether the citizen was on a very simple android, 16 gigs, or on a top-of-the-line iPhone, or on a top tablet, the system presented itself to him amicably and he could fill out the registration, and then fill in his answers in a simple manner. We didn't need citizens to download the application anymore, for them to participate. (…) we began to realize, during the first days, that we did not have a large number of downloads [of the application] in the stores, and we started to understand "hey, change that, turn the campaign now to just Access the Site" (Interviewee 8, "Ouvindo Nosso Bairro").

The digitization of the "Ouvindo Nosso Bairro" was inspired by the Digital Participatory Budget policy of Belo Horizonte (Matos et al., 2019). The Salvador administration was concerned with the voting fraud that happened at Belo Horizonte's policy, and this led them to adopt a different online user validation system. The Belo Horizonte policy validated the citizen's vote by the voter's title (Marquetti et al., 2008). For the "Ouvindo Nosso Bairro", validation occurs through the individual taxpayer ID number ("Cadastro de Pessoa Física", CPF). This process requires the validation of the citizen's document with the Treasury Secretariat's ("Secretaria da Fazenda") database and, if there is no parity, validation with the Special Department of Federal Revenue of Brazil's database is required, which incurs a cost, as stated by interviewee 8:

(…) These guys can start generating CPFs, do you know of CPF generators? All it takes is parity... And I said to the director that it's going to have a cost... If we need to criticize the CPF, that is one thing. You know, just to check the parity, whether it matches or not, so you let the guy in. But for you to make sure that the person exists, I have to go to the Treasury Secretariat. And if, for some reason, that person is not there in our base if it is in our base, it has no cost, understood? But if I have to get it from the Receita Federal [Federal Revenue of Brazil], I know it has a cost. So, the director said, "ok, we're going to do it". The first step was for the person to enter with their CPF, and then we validated if that person existed. (Interviewee 8, Ouvindo Nosso Bairro).

The third “Ouvindo Nosso Bairro” iteration took place in 2021. The policy continued with the same previous format, however, due to the COVID-19 pandemic, it had to be adapted to meet the sanitary restrictions. Synchronous meetings were maintained in an online format. Hybrid interactions still occurred within the 10 “Prefeituras-Bairro” units, upon prior scheduling by citizens. There was a reduction in the total number of participants to 53,882, combining approximately 21,000 votes from the online suggestion stage and 32,000 votes from the online voting stage (Secretaria de Comunicação, 2021b, 2021a).

4.2 Saúde Já Curitiba

Before understanding the Saúde Já Curitiba program and, more importantly, its rapid adaptability, it is necessary to observe that digitizing healthcare has been ongoing since 1999. Saúde Já Curitiba is just one element of this process. In 1999, an information system was implemented throughout the Primary Care Network. The system, then Cartão Qualidade Saúde (CQS), integrated citizen records, establishments, and procedures based on the patient's electronic medical record. CQS pioneered capturing reliable real-time information, facilitating the monitoring of the work process (Secretaria Municipal de Saúde de Curitiba, 2023a). In 2012, CQS was replaced by e-Saúde, a system still in use (as of May 2023). Beyond the functions that CQS already performed, e-Saúde also integrated all areas of the Municipal Health Secretariat into a single system: Primary Care; Urgency and Emergency; Dentistry; Epidemiological and Sanitary Surveillance; Control; Evaluation; Audit; and Regulation. During interviews, elements of a more applied and comprehensive vision of digital health were sought, especially regarding how managers assess the integration of digital resources into the community and healthcare infrastructure. As demonstrated by Interviewee 2 (Saúde Já) in this interview excerpt:

If I have good facilities, good technology equipment to treat the patient there: take an X-ray, do a CT scan... But also information about that patient, I can better understand their problem, and solve their problem, right? But at the same time, when I build a system like this, no matter how first-world it may be, no matter how fantastic it is... In terms of applied technology, it is useless if it does not consider [for instance] whether Dona Francisca, who lives in Caximba [a poor neighborhood of Curitiba], will benefit from it. If I start from the premise that I will add technology and shift in-person care to other activities, I will leave these people without care and not improve their care. (Interviewee 2 - Saúde Já).

Starting this greater integration of citizens with the system in 2017, the Municipal Government of Curitiba, under pressure from the mayor, implemented the Saúde Já App. Initially, the main concern was eliminating early morning queues for scheduling appointments at UBS. The app then began to function for appointment scheduling. However, in the first few months, it was noted that a large portion of the population could not access Saúde Já because users used smartphones with much older software than what the app supported, causing Saúde Já not to run or even download on these devices. Here, we have the first major transformation of the Saúde Já app: the configuration was changed to make the app compatible with all smartphone operating systems. Interviewee 3 (Saúde Já) reflects on the use of tools and technological innovations in healthcare without falling into the trap of "innovating just for the sake of innovation," especially when considering the perspective of public health:

You need to work with a healthcare system that accommodates technological innovations, but technological innovations have to be designed to serve something... they have to make a difference, and that's where our app became this great link." (Interviewee 3 - Saúde Já)

The Municipal Health Plan of Curitiba 2022-2025 (Secretaria Municipal de Saúde de Curitiba, 2023b) highlights that the Saúde Já app, in addition to scheduling appointments, has new functions. One is the "Meu Pré Natal" (My Prenatal) function, aimed at pregnant women, providing information about pregnancy stages, including a contraction calculator to indicate the right time to go to the maternity ward during childbirth. Another function is guidance for urgent cases, including traffic accidents, medical and dental emergencies, sexual violence, and HIV contact. Furthermore, the app offers appointment and exam confirmations, with a history and transaction code stored within the app, and the ability to evaluate any care provided in the UBS or the service provider network. There are also informative messages about health programs and actions conducted in the UBS, as well as a virtual vaccination card that includes vaccination history, pending vaccinations, and notifications of vaccination campaigns. In 2020, with the COVID-19 pandemic, integration with the Telemedicine Center was added, as part of the pandemic response strategy, along with medical video consultations, general health service guidance, appointment scheduling, and system e-health registration updates. Thus, the pandemic forced the second transformation of Saúde Já Curitiba, adding these new and important features to combat the pandemic.

Impacted by the adaptations required to address the pandemic spread of COVID-19, the search for the expansion, qualification, and modernization of public health services is reflected in products and services aimed at integrating technology into humanized healthcare in Curitiba: connectivity, intelligence, and database applied for the benefit of the population. Electronic medical records, video consultations, and telehealth services are aligned with new initiatives for specialized care and health surveillance, marking the evolution of services in all their breadth (Secretaria Municipal de Saúde de Curitiba, 2023b, p. 158). This discourse of adaptation and innovation is observed

in the projects, guidelines, and approved proposals in the Municipal Health Plan of Curitiba 2022-2025 (Secretaria Municipal de Saúde de Curitiba, 2023c).

4.3 Cases intersections

Both the "Ouvindo Nosso Bairro" and "Saúde Já Curitiba" programs have shown the importance of the municipal management's concern with the digital divide, and how it molded both programs. In Salvador, the management had to adapt to the difficulties imposed by digitization. Their initial internet access precautions were insufficient for the population to participate in the program. The technology had to be adapted to the local population's hardware restrictions. The city's administrations changed the channels of interaction with the program, from the application to the website, and made it more responsive to all devices. The "Saúde Já Curitiba" program also faced difficulties with older operating systems. The application had to be adapted to work on all operating systems to serve the city's entire population. Figure 3 illustrates the relationship between the challenges faced in both cases and also links them to the three levels of digital exclusion.

CHALLENGES			
	First level/internet access divide People who do not have access or connection to the internet	**Second level/skills divide** People who are unable to use digital tools	**Third level/beneficial outcomes of Internet use** People who are unable to gain real-world value or benefits from their use of technology
Ouvindo Nosso Bairro Salvador	- Low memory capacity of the smartphone devices - Lack of internet access by part of the population	- Illiteracy rate among the adult population of Salvador. - Citizen's struggle with using and understanding the website.	- Citizens don't have a long-term memory and understanding of the policy. - Citizens don't know about the policy's existence. - Citizens being manipulated by local leaders into voting without fully understanding the policy. The policy became a "Local leader's dispute" for their work.
Saúde Já Curitiba	- Users had smartphones with much older software than what the app supported - Lack of internet access by part of the population	- Citizens struggle with creating an account, logging in and/or solving technological problems	- Lack of knowledge among citizens to address their health issues using the available tools - Citizens did not see benefits in using an app rather than going to the UBS

Fig. 3 - Comparative challenges of the Ouvindo Nosso Bairro and Saúde Já Curitiba programs. Created by the authors.

During the pandemic, "Saúde Já Curitiba" incorporated sanitary guidelines and was integrated with the Telemedicine Center. On the other hand, "Ouvindo Nosso Bairro" underwent adaptations to continue running, despite the difficulties imposed by the sanitary requirements. Synchronous meetings were held in digital format and, to assist the population with challenges, the program continued to be run in a hybrid format by appointment. These and other solutions (Figure 4) were necessary for the continuity of the programs and the increase in engagement.

SOLUTIONS			
	First level/internet access divide People who do not have access or connection to the internet	**Second level/skills divide** People who are unable to use digital tools	**Third level/beneficial outcomes of Internet use** People who are unable to gain real-world value or benefits from their use of technology
Ouvindo Nosso Bairro Salvador	- Migration from the application platform (required higher memory to download) to a webpage. - The web page's interface was made lighter to facilitate user access and voting. - Free internet access points were installed at key locations of the city. - Hybrid policy: on-site city officials were positioned at key locations in Salvador with a tablet to help citizens participate in the policy. It was also possible to participate locally at each Prefeitura-Bairro unit.	- Hybrid policy: on-site city officials at key locations of Salvador and Prefeitura-Bairro street-level bureaucrats would help people with participation. - The webpage interface was made easier and simpler for citizen registration and interaction. - Backoffice: Validate citizens' registration through their CPF (Individual Taxpayer Registration) with the Receita Federal (Federal Revenue) database.	- Disclosure of the policy through media/social media channels. - Disclosure of the different steps of the policy, from voting to implementation and work inaugurations.
Saúde Já Curitiba	- The app configuration was changed to make the app compatible with all smartphone operating system	- The Telemedicine Center with a phone number was created to address citizens' accounts and technological problems	- Increased promotion of the Saúde Já Curitiba app - Mandatory use of the app during the COVID-19 vaccination program - Addition of more features and services

Fig. 4 - Comparative solutions of the Ouvindo Nosso Bairro and Saúde Já Curitiba programs. Created by the authors.

The "Ouvindo Nosso Bairro" and "Saúde Já Curitiba" cases demonstrate the importance of addressing the digital divide through the adaptation of municipal policies. Both faced technological challenges, such as hardware and operating system limitations, which required shifts to more inclusive platforms. During the COVID-19 pandemic, the programs showcased resilience by integrating telemedicine and hybrid participation formats, ensuring continued service and engagement. Figures 3 and 4 highlight how these challenges and solutions addressed the three levels of the digital divide.

5. Discussion

The cases studied exposed the need for adaptations when introducing new technologies to the population. Both programs were able to adapt to better meet the demands and needs of their citizens. Beyond the cases mentioned, it is highlighted that digital government practices must ensure that public services are planned and provided in such a way that the benefits of digital transformation are available and accessible to all, including those who depend on face-to-face interactions. Therefore, it is necessary to look both inward and address the context and governance (such as administrative structures), as well as outward, focusing on the needs of users throughout their experience with public service, regardless of whether it is delivered by mail, telephone, in person or through a digital device (Welby and Tan, 2022). Each e-policy studied faced challenges during its launch and only managed to have a higher number of users once they were adapted to minimize the local barriers, confirming the need for adaptation of e-policies to its context to reach a higher number of people (Baatiema et al., 2023; Catalina-García & Galera, 2003; Kim et al., 2023; Zhang et al., 2022).

The COVID-19 pandemic was a period that forced the digitalization of many municipal services. Successful policies during the pandemic were the ones that understood their contextual challenges regarding the digital divide and adapted the program, especially through the use of more responsive interfaces and the inclusiveness of different channels and devices for communication with citizens (Acosta-Vargas et al., 2022; Baatiema et al., 2023; Kim et al., 2023). The different levels of the digital divide created barriers that needed to be addressed by the municipal government for their policies to reach a higher number of users. In both cases, citizens already had access to technology in the form of smartphones and yet, due to the diversity of the types of smartphones, the policies did not originally reach citizens. Smartphone limitations, such as the memory capacity, or older models with outdated versions of the operation system, were major limitations in the technology that required the policies to be redesigned. When considering the different levels of the digital divide, the redesigns of the policies were aimed to address the first and the second levels by providing more access to citizens, either through alternative channels, by asynchronous and on-premise attendances, or by adapting the e-policy/platform to cater to more devices. However, the third level of the digital divide (van Deursen & Helsper, 2015) did not receive that much attention from the municipal governments and it was only partially considered through the disclosure of the policies.

The digital divide is more nuanced than just the three levels mentioned above, such as the characteristics of the population and of the local context and how they impact citizens' accessibility and use of e-services (Macaya et al., 2021). However, both e-policies studied did not account for these nuances in their actions toward mitigating the digital divide and increasing the policies reach to the population. We positioned that the e-policy should incorporate strategies to reach out to these different population strata to overcome the digital divide. For instance, Panganiban (2018) showed how simple solutions tailored to a specific population increase the reach of an e-policy, such as creating a more informal setting for an ICT teaching center that would encourage a shy and rural population for attend it, or incorporating already known technologies instead of proposing new ones.

Answering the Research Questions

Through the two case studies, it was possible to draw some conclusions about the policy designs that helped the digital policies reach a higher number of citizens by addressing the digital divide at different levels, thus answering our initial question, “How can digital public policies be designed to maximize citizen engagement and ensure equitable access to services, while addressing systemic inequities and adapting to local socioeconomic and technological contexts? The following suggestions compile our findings in e-policy design and also answer our secondary questions on possible mechanisms that improve the reach to citizens by addressing the digital divide. These recommendations are also responding to Madsen et al. (2014) in the need for bridging research in e-government with practice:

- Backoffice: municipalities may experience hardships with database parities when validating citizens' registration in the e-policy. A possible solution is to validate the ID with a citizen registration database at the federal level, such as with a federal revenue agency. Validation is important to guarantee the safety of the users as well as the validity of the e-policy.

- Policy design addressing the first level of the digital divide: responsive and lighter interface. Prepared to run on multiple platforms, either by web browser or applications that are light (low-memory consumption and responsive) and can run on multiple operating systems, even in older, outdated versions. Also, on-premises possibilities for technology use and access at key locations are important to guarantee access to technology and to the internet in contexts where they are not easily available to all citizens.

- Policy design addressing the second level of the digital divide: all e-services should be hybrid with on-premise and other types of asynchronous citizen support, such as telephone channels. The more different types of channels supported, the easier it will be for citizens to troubleshoot or access assistance in using the e-service, as well as accessing the service offline in traditional on-premise formats.

- Policy design addressing the third level of the digital divide: the third level of the digital divide is more challenging to address. Different mechanisms were employed in the cases studied to instigate a long-term memory and understanding of the policy, but some of the results were not fully successful. Those mechanisms included investment in the disclosure of the policy through different media/social media channels, mandatory use of the application during the COVID-19 pandemic, and even the addition of more features to the application/e-service. We argue that there should be more public deliberation with citizens to better explain the e-service, and e-services in general, to raise their awareness, especially targeting segments of the population that face more challenges in accessing and understanding e-services, based on race, age, gender, income, and education (Macaya et al., 2021).

6. Conclusion

The study addresses the role of municipal governments in designing equitable digital public policies while dealing with a partially digitally divided population. It also underscores the critical need for adaptive and inclusive digital public services, policies, and programs so citizens do not become unassisted of basic government services - for example, in Saúde Já Curitiba, the program ensures public health access. By analyzing the "Ouvindo Nosso Bairro" and "Saúde Já Curitiba" programs, the article highlights the challenges and solutions in implementing inclusive e-services and it becomes evident that municipal governments must account for local technological, socioeconomic, and contextual barriers to ensure broader citizen engagement.

The study emphasizes the importance of designing digital services that address all three levels of the digital divide: access, skills, and outcomes. Local adaptability emerged as a crucial factor, demonstrated by the implementation of responsive platforms, hybrid access models, and user-centered designs that cater to diverse population needs. As happened during the COVID-19 pandemic, when both programs showcased resilience by incorporating innovative solutions such as the Telemedicine Center and hybrid participation formats, ensuring continuity and inclusivity. From these findings, critical lessons for policymakers include the necessity of hybrid approaches that integrate digital and in-person services to enhance accessibility, the importance of iterative adjustments that account for local technological and socioeconomic contexts, and the need to go beyond access by addressing digital literacy and fostering the meaningful use of technology. These insights underscore the importance of adaptability and inclusivity in the development of effective digital public policies.

Following Twizeyimana & Andersson's (2019) main application domains of e-policies, our findings were concentrated in the e-service domain. More research could be done specifically looking at the other domains. Specifically, more research on the E-Administration domain could help understand the impacts of the digital divide and possible solutions to mitigate them from the inner perspective of the government. Also, more research on e-service at the local level could improve our findings with different inputs from other cases and experiences in how e-policies could be adapted to answer the digital divide.

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