

*Analysis of Rio Grande do Norte applications for citizens*

**Análise dos aplicativos do Rio Grande do Norte voltados ao cidadão**

*Análisis de las solicitudes de Rio Grande do Norte para los ciudadanos*

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**Abstract:** *With the technological advances in the current century have evolved e-gov to mobile government (m-gov), whose provision of public services occurs through applications on mobile devices, such as smartphones. Based on this, this study focused on analyzing the usability of the applications used by the state of Rio Grande do Norte to offer services or information that would be provided in person. For this purpose, a booklet from the federal government was used as an instrument of analysis, which points out usability guidelines to be followed by the federal entities when making public services available electronically. As a result, a certain leveling was found between the applications regarding the usability criteria met. However, despite being level, the applications signal for a still inexperienced m-gov management, but which can be improved to be convenient to meet the needs of the citizen, in addition to allowing other traditionally in-person services to also be made available through mobile platforms.*

**Keywords:** *Electronic Government. Mobile Government. Usability.*

**Resumo:** Com os adventos tecnológicos surgidos no século atual evoluíram o e-gov para governo móvel (m-gov), cuja prestação de serviços públicos ocorre através de aplicações em dispositivos móveis, como smartphones. A partir disso, esse estudo objetivou analisar a usabilidade dos aplicativos empregados pelo estado do Rio Grande do Norte para ofertar serviços ou informações que seriam prestados presencialmente. Para tanto, foi utilizado como instrumento de análise indicadores construídos a partir de cartilha do governo federal que aponta diretrizes de usabilidade a serem seguidas pelos entes federativos ao disponibilizar serviços públicos em meio eletrônico (Padrões Brasil e-Gov, 2010). Como resultado, foi encontrado certo nivelamento entre as aplicações quanto aos critérios de usabilidade atendidos. Entretanto, apesar de nivelados, os aplicativos sinalizam para uma gestão de m-gov ainda inexperiente, mas que pode ser aprimorada para ser conveniente ao atendimento das necessidades do cidadão, além de possibilitar que outros serviços tradicionalmente presenciais também sejam disponibilizados através de plataformas móveis.

**Palavras-chave:** Governo Eletrônico. Governo Móvel. Usabilidade.

**Resumen:** *Los avances tecnológicos del siglo actual han hecho evolucionar el e-gov al gobierno móvil (m-gov), cuya prestación de servicios públicos se produce a través de aplicaciones en dispositivos móviles, como los teléfonos inteligentes. Con base en esto, este estudio se enfocó en analizar la usabilidad de las aplicaciones que utiliza el*

*estado de Rio Grande do Norte para ofrecer servicios o información que se brindaría en persona. Para ello, se utilizó como instrumento de análisis un índice de indicadores construido a partir del cuadernillo del gobierno federal, el cual señala las pautas de usabilidad que deben seguir las entidades federativas para la puesta a disposición de los servicios públicos de manera electrónica. Como resultado, se encontró una cierta nivelación entre las aplicaciones en términos de los criterios de usabilidad cumplidos. Sin embargo, a pesar de estar niveladas, las aplicaciones apuntan a una gestión de m-gov aún sin experiencia, pero que se puede mejorar para que sea conveniente para satisfacer las necesidades del ciudadano, además de permitir que otros servicios tradicionalmente presenciales también estén disponibles a través de plataformas móviles.*

**Palabras clave:** Gobierno Electrónico. Gobierno Móvil. Usabilidad.

## **Introduction**

The evolution of technological resources in recent decades has begun to redefine the interaction between individuals in society. This evolution occurred through Information and Communication Technologies (ICTs), whose main culprits were the development and dissemination of microcomputers, cell phone devices, as well as telecommunications in general, with emphasis on the internet (Cepik & Canabarro, 2014).

In Brazil, nowadays, this evolution can be proven through data from the continuous National Household Sample Survey (Continuous PNAD, 2018), which reveal that 74.9% of permanent Brazilian households used the internet and that 98.7% of these households accessed the internet via mobile phone.

Furthermore, this change in interaction through ICTs was not restricted only to individuals, but also reached organizations, as the technological factor evidenced by ICTs encouraged the construction of the knowledge society, whose leading role in this process was performed by the internet. This, by boosting the cyber modernization of organizations, produced new institutional arrangements, in addition to new forms of relationship with individuals (Baldissera, Rovari, Mello & Fiirst, 2017).

In this context, still according to the authors, public organizations began to redefine their interaction with individuals, adopting new forms of relationship for this purpose, resulting in digital channels that began to mediate the relationship between the State and citizens. This results in the provision of more qualified public services and, at the same time, works to provide public management with an apparatus of efficiency, transparency, social control and democratic participation.

Therefore, the establishment of ICTs in society reconfigured not only the way of life of individuals in the global community, but also significantly restructured the organization of territories (Moraes, 2018), causing the figure of the State to readapt to new times and seek to exercise its duties through available technology. The aim is, therefore, to serve citizens in formats different from the traditional bureaucratic model through the massive use of ICTs, mainly with the internet, remodeling not only the conventional administrative routines of providing services at counters or ticket windows (back-office), but the coexistence between public management and its public (Cepik & Canabarro, 2014).

In view of the foregoing, the change in the relationship between Public Administration and society, through the implementation of ICTs in governments, began a process that was called electronic government. This process consists of changing how public management carries out its duties and improves its capacity to promote efficiency, governance, public policies, intergovernmental integration and digital democracy, raising the levels of transparency, popular participation and accountability of state administrations (Przebylovicz, Cunha & Meirelles, 2018).

For these authors, the union between government and ICTs contributed to improving the relationship between State and society, as it modernized public administration, causing it to reformulate its processes, mitigating its bureaucratic nature and eliminating the need for face-to-face service, as it contributed to bringing closer citizens and government, in addition to increasing its performance in relation to its objectives by employing technological devices focused on information technology and communications.

Thus, in Brazil, the idea of electronic government (or e-government/e-gov), despite some initial experiments carried out in the last decades of the 20th century, began to be officially adopted by the Federal Government following the Presidential Decree of April 3<sup>rd</sup>, 2000, which created the Interministerial Working Group dedicated to working in the areas of universalization of services, through the project 'Government within everyone's reach and advanced infrastructure' (Araujo, Reinhard & Cunha, 2018), with the promotion of e-government being kept in subsequent federal government administrations.

Currently, electronic government in the country is not restricted to the Federal Government, as despite its presence at the forefront of this segment, the insertion of ICTs in state action is also found at other levels of government (Salgado & Aires, 2017). Regarding this, Barbosa, Faria and Pinto (2007, p. 523) argued:

At state and municipal levels, the adoption of technological resources and public IT systems has allowed many social advances: systems for scheduling medical appointments in hospitals and health centers, automated school enrollment systems and stores (squares) with integrated service that, complemented by the delivery of services through government portals on the internet, eliminates the need for citizens to be present in government agencies.

However, as ICTs evolved in recent decades, starting to operate in a wireless and portable format, governments also sought to adapt to their advances and began to offer government services in applications for use on mobile platforms, receiving the classification of mobile government (m-gov) or mobile citizenship (Lemos & Araujo, 2018).

This modality, in short, consists of access that citizens can have to traditionally bureaucratic Public Administration services through mobile devices, such as smartphones, tablets or palmtops. Thus, mobile government aims to offer society these bureaucratic services in an integrated, transparent, friendly, easy and accessible, safe, fast, and private way, through appropriate devices accessed at the moment and in the place desired by the end user (Pinto & Almeida, 2020).

Therefore, due to the space occupied by technology today, acting in the contemporary way of life to the point of modifying interpersonal and inter-organizational relationships, as well as between State and society, this study aims to contribute to studies relating to the Brazilian public management, especially the discussion about mobile government as a public policy for access to services aimed at citizens in the state of Rio Grande do Norte (RN). This is an area that still lacks scientific studies at a local level. This study also aims to collaborate with the m-gov landscape in RN regarding the usability of government applications.

That said, the general objective of this study is to analyze the applications of the government of the state of Rio Grande do Norte, available on the Play Store, on Google Play, based on the institutional document of the Brazilian Federal Government, Web standards in electronic government: usability booklet; while the specific objectives are to identify applications that meet the usability booklet guidelines; and check the applications that demonstrate the most usability in relation to citizen service.

## Theoretical elements of the study

The rise of the internet between the late 1980s and early 1990s, as a result of technological development that occurred mainly after the Second World War, resulted in the advancement of its applications not only within the private sector and civil society, but also in government organizations around the planet.

The popularization of the internet, as well as of other technologies such as computers and cell phones, for example, initiated changes in the way communication occurs between people and organizations, regardless of existing distances, also transforming the way information travels, taking into account that the insertion of the world into the network environment allowed communication to be operated more quickly (Mendonça & Zuliani, 2015).

This traffic of information in networks, which changed communication on the planet, ended up earning the nickname of Information and Communication Technologies (ICTs), whose development prospered to the point of making them accessible to any individual and anywhere on the globe. Still according to the authors

The diffusion of network technologies further advanced in the area of telecommunications and computing with the invention of portable and increasingly smaller devices capable of supporting access to the internet and to other networks, which spread quickly, such as notebooks, netbooks, advanced cell phones with internet access (smartphones) and tablets (Mendonça & Zuliani, 2015, p. 78).

In view of this transformation in the media, changing the modus operandi of information management, public organizations also underwent transformations, as in the late 1970s and early 1980s, public administration around the planet demonstrated fatigue in relation to its bureaucratic management model, just as the economy was immersed in a serious fiscal crisis. As a result, the answer found to address these problems was to reform public management, initiating the so-called New Public Management (NPM), whose purpose was to provide quality public services, focusing on citizens and their demands, and ensuring an administration based on successful experiences of the private sector. To this end, the NPM considered, as principles, the result as the main objective, the search for efficiency in the performance of processes, the construction of good governance with the players involved, in addition to the design of the public sector with a focus on the market model, aiming at competitiveness (Braga & Gomes, 2016).

In this way, public administration, from the perspective of new public management, sought to adapt to this new era and informational society. In this context, technological adaptation occurred to ensure that Public Administration was modernized, using ICTs to drive this restructuring of organizations, contributing to forging the expression “electronic government” or “e-Gov”.

In turn, electronic government can be seen as a new vision of the use of technologies to provide public services, changing the way in which governments interact with citizens, companies or other governments (Przeybiloviczet al., 2018), as that technology brings governments closer to citizens, as well as to companies, without the need for mediators or interlocutors.

That said, this link without mediation between the government and other players is classified into three categories, namely G2C, G2G and G2B, as can be seen in Table 1.

Table 1

<b>Types of relationship promoted by e-gov between the government and other players.</b>	
<i>G2C (Government to Citizens)</i>	It is defined as the relationship between government and citizens with respect to the electronic provision of public services and information.
<i>G2G (Government to Government)</i>	It relates to the intra or inter-government relationship to promote the execution of internal duties, with a view to optimizing management and, consequently, reinvigorate public service.
<i>G2B (Government to Business)</i>	It relates to the interaction between government and businesses in order to serve Public Administration, whether with respect to its internal needs or those of the citizens.

Source: adapted from Almeida (2014).

Thus, e-gov emerges with the role of collaborating with the lives of government clientele, providing a more active and harmonious relationship between State and society, as the NPM reconfigured this relationship by adopting citizens as the center of attention, pushing them to get closer to the public administration, causing them to become aware of how it works and helping them to decide which actions best meet the demands of society. In other words, citizens must participate in the life of the government for it to act effectively in their lives.

This mutual collaboration between governments and citizens, from the perspective of NPM, was called public governance, being understood as the use of political, economic and administrative authority in the affairs of a country, including the articulation of citizens to defend their interests and the exercise of their rights and duties, or even as the technical and political resourcefulness capable of allowing a government to implement its already programmed public policies (Buta & Teixeira, 2020). Thus, it can be understood that public governance is about the collaboration of civil society in the governmental decision-making process, aiming at the construction of public policies that meet their collective expectations.

In view of this, as e-gov began to gain strength within the Brazilian public administration, as well as the need to engage in dialogue with citizens, the idea of governance was incorporated into the dynamics of e-government, giving rise to the term electronic governance (e-governance), which consists of the way in which the internet can improve the State's ability to govern and formulate its policies (Baldissera et al., 2017), that is, the expansion of the possibilities for social participation promoted by ICTs, bringing the State and society closer together with the intention of making the government aware of citizens' demands and thus being able to meet them in the most appropriate way.

Therefore, many authors understand that the e-governance concept does not end there, as it is quite comprehensive, allowing us to classify this reinvention of government activities into three major areas: e-public administration, e-services and e-democracy. Thus, the definitions of these areas are included in Table 2.

Table 2  
E-governance areas.

Area	Definition
E-public administration	Improvement in governmental management based on the use of ICTs to resources and processes aiming at the optimization of public policies.
E-services	Improvement of services provided to citizens through the use of electronic media.
E-democracy	Expansion of the citizenship-based participation mechanisms in governmental decision-making through ICTs.

Source: adapted from Cunha, Annenberg & Agune(2007).

Based on this, it can be seen that electronic governance cannot be seen as just the simple use of technologies by the government to help its public with their daily needs; or the adoption of technology to replace the usual bureaucratic procedures, as its dimension focuses on the realization of the democratic environment, helping to promote responsiveness in citizens and in public management (Mendonça & Zuliani, 2015).

Therefore, for democracy to be fully effective – as a political system of popular participation in decision-making processes – it is necessary for citizens to fulfill their role as central pieces in the gears of the public sector, starting to interact directly with the government.

This relationship, however, is not destined to occur only physically, in the back-office mode, or virtually through websites or portals accessed statically on the screen of a personal computer (PC), as the technical-scientific development in telecommunications in recent decades has caused changes in the interactive logic between the government and the governed (Souza, Araújo, Araújo & Silva 2014), giving rise to the provision of electronic government services through mobile platforms, the so-called m-gov, which is defined as the use of mobile and wireless technologies, services and applications for e-government users, such as citizens, suppliers and all government units (Salameh, 2020).

Thus, due to these technological advances, electronic government began to be redefined with the emergence of m-gov, when new possibilities for providing public services began to be explored, as the service or information previously provided on a website or portal, statically, on a PC screen at home, at work, in an educational environment, at an internet café, etc., now occurs on portable screens of smartphones, PDAs, handheld devices, among others, through applications within the reach of citizens, enabling access at any time and place.

Thus, it can be inferred that mobile government, through its applications, is endowed with characteristics that cause it to rearrange its Government to Consumer (G2C) relationship, namely the individualization of information, uninterrupted connection and its unrestricted portability (Salameh, 2020). According to this author, these characteristics aim to ensure that government services and information will be made available in a friendly, fast and easy way, with quality, at a fair price and with security, always according to the perspective of its users.

However, even though m-gov exhibiting an advanced level of specialization in relation to conventional electronic government, its purpose is not to succeed it, but to complement it, as Mobile Government was not developed to replace traditional e-gov, but rather to complement it, in order to enable citizens to access services through new platforms (Hanada, Tavares & Costa, 2020).

Therefore, mobile government becomes relevant as an apparatus responsible for enabling dialogue between the State and citizens. For this tool to function properly, without interference in establishing communication, both parties must be in tune, speaking the same language, allowing the

government to learn about the citizens' need in order to serve them in the most appropriate way, taking into account that society expects efficiency, agility and the provision of benefits from its governments (Wirtz, Birkmeyer & Langer, 2019).

For this to occur, it is necessary to develop a reciprocal alignment between government and citizens, structuring services according to the needs of the social context and not of the bureaucratic structure (Hanada et al., 2020). It is therefore necessary for the government to adopt the idea that public services should be oriented towards meeting the needs of citizens.

By adopting this logic, focused on the citizen's daily life, in m-gov the citizen becomes the integrating element, so that their knowledge about the processes will lead them to perform the service determined by their demand (Wirtz et al., 2019).

Therefore, if the fundamental premise of e-gov is to satisfy the social desires of the population through the possibilities provided by ICTs (Cunha, Coelho & Przeybilovicz, 2017), mobile government aims to do so in a way that services are convenient for citizens, ensuring that their access and use are simplified, without many demands, making the service understandable and attractive to users, demonstrating its usability. It therefore expects users to be able to use it without difficulties, given that no matter how good and necessary a mobile service is, it will not be useful nor accessed if the citizens do not know how to find it or consider it too difficult when compared to the in-person or stationary electronic service (Sartor, 2017).

Therefore, it is up to m-gov to ensure that its applications provide sufficient usability to meet the needs of citizens, causing e-government to achieve its purpose: to be beneficial to users' lives (Przeybilovicz et al., 2018).

Within this context, some recent studies have been identified that investigated usability of applications, and their research highlights their analysis in government applications for mobile devices. These studies seek to understand, in short, how useful the applications being analyzed are to citizens, taking into account the ease with which they are operated.

In this sense, Estaregue, Gonçalves, Lopes, Cavalcante and Cacho (2017) present a usability assessment of an application linked to public security – ROTA-PVM, which measures and examines ten aspects of the application's usability, scoring only those items that are well evaluated. The questionnaire was answered by five volunteers who are part of the project platform that developed the application under study. The result found was a high level of usability in the application, however some points, such as, for instance, menu formatting, could be improved. Finally, the study also indicates that the questionnaire should be applied again with new volunteers, who should have the profile of its usual users, police officers and commanders, aiming to compare the information obtained in the study.

In the study conducted by Lara, Gosling and Rodrigues (2018), the main purpose was to evaluate mobile applications that centralize the provision of services in the states and the Federal District in light of best practices in national and international literature regarding the improvement of the relationship with citizens. Thus, only ten federal units that met the study's objective were selected. Regarding the methodology, after a survey of the criteria for evaluating applications in national and international literature, eight categories of analysis were chosen, including usability, with the theoretical contribution from Chanana, Agrawal and Punia (2016) standing out. The results regarding usability showed that 90% of the applications have visual standardization, that 70% have always visible main navigation, that 20% allow the customization of the most used services on the application's home page, that 40% of the applications allow registration for the regular use of registered information to access the services and that 20% have a base application for accessing other government applications, serving as a portal of public services. In their final considerations, the

authors emphasize that the applications being evaluated still do not take advantage of the possibilities that mobile government can offer and that state governments should develop plans that prioritize m-gov in services aimed at citizens.

Schneider, Oliveira, Barni, Ferreira and Tezza (2018), on the other hand, sought to understand difficulties that limited users from accessing the *Transparência Móvel-SC* [Mobile Transparency] application. The methodology used involved questionnaires and tests applied to users, collecting primary data. The selected users were ten public employees, taking into account that the information made available on the transparency portal of the State of Santa Catarina is of interest to them due to the relationship with their work. The questionnaires and tests were developed based on the methods of Tullis and Albert (2008) and Nielsen (1994) for assessing usability. As a result, poor usability was found, as the application being evaluated is a web page already developed for desktop format that was adapted for use in a mobile device context, requiring improvements to be made to the application.

In view of the above, it is observed that different methodologies were constructed and used to assess the issue of usability of government applications, demonstrating that the theme is broad and can be explored from different perspectives. Therefore, the methodological procedures used in this study will be described next.

### **Methodological elements of the study**

The descriptive model was established as the research methodology for this study, as it proposes observing and reporting physical and human phenomena without causing interference, striving to portray the practical performance of the object being analyzed (Prodanov & Freitas, 2013). This model was shown to be the most suitable for achieving the purposes of this study, as it can be applied to understand “the level of service provided by public agencies in a community” (Gil, 2002, p. 42).

Therefore, due to the selection of the descriptive model, a qualitative approach to the problem was adopted, whose focus allows the analysis of the phenomenon within its context, extracting data directly from the observed reality (Prodanov & Freitas, 2013), as this approach focuses on investigating the particularities of situations, events and organizations with an emphasis on the manifestation of the phenomenon, enabling its understanding.

To this end, the case study technique was chosen as the methodological procedure, which consists of collecting information for the purpose of investigating a phenomenon, aiming to understand it in detail (Prodanov & Freitas, 2013), where the information obtained is the result of the application of strategies for collecting data with the intention of producing a theoretical framework that guides the study regarding the object studied.

From this perspective, the first step of the study was to choose the protocol for analyzing the applications. The protocol chosen was the bibliographic review, which aimed to guide the essential concepts regarding the topic being studied. This was crucial for the next stage, as the literature review led to the discovery of the document *Web Standards in Electronic Government: usability booklet*, produced by the Ministry of Planning, Budget and Management of the federal government, whose purpose is to offer recommendations for the creation of electronic websites, and which can also be used for the construction of “any application developed by the government” (Brazil e-Gov Standards, 2010, p. 6).

The selection of this protocol considered that it was based on standards from the World Wide Web Consortium (W3C), an international organization that develops protocols and guidelines for the creation and interpretation of content on the internet. In addition, this protocol has already been used

in previous studies conducted by Santos, Bernardes, Rover & Mezzaroba (2013) and by Bernardes, Santos & Rover (2015).

In this document, usability is understood as a set of techniques that aim to ensure the uncomplicated use of electronic platforms, ensuring the desired behavior during their use (Brasil e-Gov Standards, 2010), that is, government information and services aimed exclusively at citizens, through ICTs, must be accessible, as well as clear and cohesive.

In a broad sense, Nielsen (1994) defines the term usability as a qualitative attribute that assesses how easy to use interfaces are. Despite the fact that, according to Schneider et al. (2018), a large number of studies focus on assessing mobile usability in technical attributes related to software, it is understood that new challenges arise from assessing the usability of mobile devices.

Following this logic of considering citizens as the central axis of the discussion on e-gov, the booklet offers seven guidelines that guide the use of usability in electronic government, namely: context and navigation (1), information load (2), autonomy (3), errors (4), design (5), writing style (6) and consistency and familiarity (7). These guidelines are endowed with several recommendations, aiming to establish principles for the construction and assessment of e-gov, as well as m-gov (Brazil e-Gov Standards, 2010).

Therefore, a screening was carried out to select only three recommendations from each guideline, as each of them consists of numerous recommendations, some of which are strictly technical in nature, with the purpose of building an index of evaluation indicators, aiming to examine whether the applications of the state of Rio Grande do Norte, aimed at serving citizens and available for smartphones, which operate with the Android technology, in the Play Store shop, meet the indicators built based on the usability booklet.

Likewise, the choice of the three recommendations was made with the purpose of understanding the objectives related to usability in the document, given that its intention is to guarantee the user the ability to use the application, ensuring that it functions in line with the citizens' expectations, that is, promoting an uncomplicated experience that captivates users to use the app at later times as they see fit, taking into account that "the fewer actions and fields to be filled in, the fewer errors users may make, and the less time it will take to complete a service" (Brazil e-Gov Standards, 2010, p. 11).

Thus, to select the recommendations that built the index of indicators, the following characteristics were used as the logic for screening: accessibility, clarity, and cohesion, due to the definition of usability and its objectives expressed in the booklet, resulting in Table 3.

To better understand the questions used in the evaluation of the apps, it was decided to describe the definition of each selected recommendation, resulting in Table 4.

Table 3  
Index of indicators for the assessment of applications

Guidelines	Questions assessed	It meets	It does not meet
Context and Navigation	Is the home page clear for the citizens?		
	Is the application's structure logical and easy to be used by the citizens?		
	Is the form for the provision of the service in the application accessible and understandable for the citizens?		
Information Load	Does the application have unnecessary elements?		
	Are the data requested from the citizens only those required for the service?		
	Do citizens have to memorize data in order to access any service?		
Autonomy	Is the "back" function available in the application?		

	Is the option interrupting or canceling a service available to the citizens?
	Does the navigation on the application obey only the citizens' command?
Errors	Are citizens warned of the unavailability to use the application?
	Is there an example in the form of the desired completion format?
	Are the form's fields filled only with the necessary number of characters?
Design	Are the application pages standardized?
	Is the information available in the application grouped and hierarchized by order of relevance?
	Does the background of the application's pages undermine its purpose?
Writing Style	Is the language used in the provision of the services clear and objective?
	In the service provision page, is the title informative and does it stand out visually?
	Is text in the service provision page spelled correctly?
Consistency and Familiarity	Is the application's structure focused on the services provided to citizens?
	Is there any difficulty navigating the application's functions?
	Does the application contact hyperlink send citizens to a form?

Source: prepared by the authors based on Brazil e-Gov Standards (2010).

Table 4

**Definitions of the booklet's recommendations**

<b>Guidelines</b>	<b>Recommendations</b>	<b>Definition</b>
Context and navigation	Clear home page	The home page must clarify its purpose, its available information and services
	Logical and easy website structure	It must be structured in an easy way for the citizens, where content is easily accessed through its structure
	User-friendly forms	Forms must be built in an user-friendly manner, exhibiting accessibility and clarity
Information load	Remove unnecessary elements from the pages	Excessive information on the pages make them unattractive to the users
	Only necessary data must be requested	There is no need to register citizens in order to access content that they would have free access in other media
	Citizens must not need to memorize data	Citizens must not need to memorize intricate data or procedures in order to access information or services
Autonomy	Keep the browser's back button available	Citizens must be allowed to go back to a previous page as they see fit
	Citizens must be allowed to interrupt or cancel a process or transaction	Citizens must be allowed to interrupt, annul, cancel or abandon, at any moment, a process or transaction that they are executing
	Citizens must have control over navigation	Citizens have exclusive control over navigation and the links
Errors	Notify users of any unavailability	Any event that interrupts the website's normal behavior must be informed in a privileged space on the home page
	In forms, show the desired format	When there is a form, the desired format must be exemplified
	Form fields must be programmed to allow users to enter only the desired number of characters	Form fields must be programmed to allow users to enter only the number of characters that the information requires
Design	Use a standard page template	The visual identity and the page standardization must take into account the role of each page
	Clearly group and hierarchize the information areas	Information must be clearly grouped, with the most relevant one being exhibited first

	Use neutral backgrounds that do not undermine the website's purpose	The pages' background must not divert users' attention from information
	Use clear and familiar language	Language used to write information and directions must be clear and objective
Writing style	Headings which are informative and visually appealing	Information headings must be easily identified and its content must be descriptive
	Correct spelling	Texts must be spelled correctly in order to convey credibility to users
Consistency and familiarity	Plan the website's structure according to the context of the tasks to be accomplished	Information and services must be organized according to the citizens' needs and interests
	Facilitate website navigation	Navigation on the website must be easy and smooth
	Contact pages must send users to appropriate forms	Contact pages hyperlinks must send citizens to an appropriate form

Source: prepared by the authors based on Brazil e-Gov standards (2010).

That said, after establishing the indicators for the evaluation, the next step was to conduct a survey to select which applications of the government of Rio Grande do Norte would be evaluated by the study. To this end, a search was carried out on the Play Store, when the applications that met the objectives of this study were downloaded, and this phase took place between November 2019 and January 2020. Thus, the filter for choosing the applications involved: 1) being an app aimed at a service provided by the government of the state of Rio Grande do Norte; 2) being an app with a finalistic nature, that is, having as its target audience, or main user, the citizen who uses the service. During the search, the following applications were identified as suitable for analysis by the study: Alerta Cidadão, Caern Mobile, ComunicaEdu, DetranRN, GPS – Defesa Civil, Matrícula Escolar RN – SIGEduc and Nota Potiguar – SET/RN. The following applications, Horus Detran RN, Governo Cidadão and SET/RN – UVT were also identified, but were not selected because they are not directly aimed at providing direct service to citizens and therefore do not meet the objective of the current methodology.

After the evaluation, a graph was created showing a ranking of all the selected applications, aiming to highlight the one(s) that best meet the adopted criteria and, consequently, the citizens' needs.

## Presentation and discussion of results

The results of this study will be presented according to the guidelines used to develop the questions being evaluated, and will be divided into seven sections. Among the applications being studied, it was not possible to evaluate, during the application phase of the methodology, GPS – Defesa Civil, because it displayed an error every time it was activated, and ComunicaEdu, because it displayed a message indicating that it was undergoing maintenance.

In the first guideline – Context and Navigation – the criteria were evaluated, respectively, through the questions: “Is the home page clear for the citizens?”, “Is the application structure logical and easy for the citizens to use” and “Is the form for providing the service in the application accessible and understandable for the citizens?”, as shown in Table 5.

Table 5

**Context and navigation guideline**

Criteria under evaluation	A.C.	Cae	Det	M.E.	N.P.
Is the home page clear for the citizens?	Yes	Yes	Yes	No	No
Is the application structure logical and easy to be used by the citizens?	Yes	Yes	Yes	No	No
Is the form for the provision of service in the application accessible and understandable for the citizens?	Yes	Yes	Yes	Yes	Yes

A.C.(Alerta Cidadão), Cae (Caern), Det (Detran), M.E. (Matrícula Escolar RN-SIGEduc) e N.P. (Nota Potiguar)

**Source:** developed by the authors.

In this evaluation, the Alerta Cidadão, Caern and Detran applications met the three criteria. The other two applications – Matrícula Escolar RN (SIGEduc) and Nota Potiguar – did not meet the first two criteria, but met the last.

The positive evaluation of the Alerta Cidadão, Caern and Detran applications, in this guideline, demonstrates that they enjoy satisfactory initial comprehensibility, allowing citizens to assimilate the environment in which the application is inserted, as well as the service offered to them, as they allow citizens to “quickly understand what public service in the m-gov version is and how it works” (Brasil e-Gov Standards, 2010, p. 13).

Regarding Matrícula Escolar RN-SIGEduc and Nota Potiguar, their unsatisfactory evaluation in the first two criteria indicates that the environment and purpose of the applications are not clear enough to inform “the person in what context they are, what the page does” (Brazil e-Gov Standards, 2010, p. 12), not clarifying, initially, to the user their applicability.

In the third criteria, it is possible to identify that the forms of the applications under evaluation are user-friendly enough for users to access and fill them out without obstacles, allowing the service to be performed, despite the aforementioned applications not providing citizens with initial understanding of their context and purpose.

In general, the results found here for the ‘context and navigation’ guideline are similar to the results obtained by Estaregue et al. (2017), who identified good usability of the application being studied, although it showed problems in the formation of its navigation menu. Lara et al. (2018) also found that 70% of the applications under study, in 10 Brazilian states, showed good navigability.

The next guideline evaluates the “Information load”, for which it was possible to make the records contained in Table 6.

Table 6  
**Information Load Guideline**

Criteria under evaluation	A.C.	Cae	Det	M.E.	N.P.
Does the application contain unnecessary elements?	No	No	No	Yes	No
Is the data requested from the citizens only that which is needed for the service?	Yes	Yes	Yes	Yes	Yes
Do citizens have to memorize any data in order to access a service?	No	No	Yes	Yes	No

A.C.(Alerta Cidadão), Cae (Caern), Det (Detran), M.E. (Matrícula Escolar RN-SIGEduc) and N.P. (Nota Potiguar)

**Source:** developed by the authors.

The second guideline assessed concerns “Information Load”, with the initial question being “Does the application contain unnecessary elements?”, and the result was that none of the applications showed unnecessary data, except Matrícula Escolar [School Enrollment] RN-SIGEduc. It exhibited an abundant amount of information about the services offered to citizens, which could lead to misunderstandings when the user operates the application, as “a high and diverse information load confuses the citizen” (Brazil e-Gov Standards, 2010, p. 16).

The second criteria was unanimously met when asked “Is the data requested from the citizens only that which is necessary for the service?”. The assessment of this question indicates that in each application the services provided are not obstructed by the requirement of unnecessary information that refers to bureaucratic procedures that occur, most of the time, when the service is provided in the back-office mode.

Finally, the question was “Do citizens have to memorize data in order to access a service?”. The School Registration RN-SIGEduc and Detran applications did not meet this criteria, as in them, services such as cancellation of enrollment and search of the national driver's license (CNH, acronym in Portuguese) always require the user to “have at hand” or “having memorized” the requested data in order to access the service. In the other applications under analysis, this need in order to use the services being provided was not found.

“Autonomy” was the third guideline to be analyzed, and the evaluation of its criteria is contained in Table 7.

Table 7  
Autonomy Guideline

Criteria under analysis	A.C.	Cae	Det	M.E.	N.P.
Is the back function available in the application?	Yes	Yes	Yes	Yes	No
Is it possible for citizens to interrupt or cancel a service?	No	No	No	Yes	No
Does navigation of the application obey only the citizen’s command?	Yes	Yes	Yes	Yes	Yes

A.C.(Alerta Cidadão), Cae (Caern), Det (Detran), M.E. (Matrícula Escolar RN-SIGEduc) e N.P. (Nota Potiguar)

Source: developed by the authors.

The School Enrollment RN-SIGEduc (Matrícula Escolar) application was the only one to meet the three criteria under assessment. The first and second criteria asked, respectively, whether “Is the back function available in the application?” and whether “Is it possible for citizens to interrupt or cancel a service?”. For the latter, none of the other applications met this criteria. The third criteria asked whether “Does navigation of the application obey only the citizen’s command?”, which was met by the other applications.

Also regarding the Autonomy guideline, it can be seen that in all services available in the Matrícula Escolar [School Enrollment] RN-SIGEduc, there is an option to return to the previous page, as well as, for example, the event registration and user creation services in the application allow for the cancellation of the service before its conclusion, as “citizens must be able, at any time, to suspend, interrupt, cancel, or abandon a process or transaction that they are performing” (Brazil e-Gov Standards, 2010, p. 19).

However, although every smartphone today has a “back” key, in certain applications this key is disabled. This absence is seen by the usability booklet as a worrying flaw, as “citizens should be able to return to the previous point in the way that is most convenient for them” (Brazil e-Gov Standards, 2010, p. 19). In the applications under study, this condition can be verified in Nota Potiguar, as when accessing any service in its sections, it is not possible to return to the previous pages or the home page when using the smartphone’s own back key. In addition, the device used may have a faulty back key, making it impossible for the user to return to the previous pages or the home page when requested. As for navigation, all applications obey only the commands sent by the user to access the available pages and consequently the services being provided, and the user is entirely responsible for navigating through the functions of the applications.

In the fourth guideline being evaluated – “Errors” – it was impossible to examine the first adopted criteria, in which citizens are asked whether “Are citizens notified of the unavailability of

use of the application?”, given that during the evaluation the applications did not show any unavailability of use. Therefore, it was decided to disregard this question for the purposes of the study. These records are shown in Table 8.

Table 8  
Errors Guideline

Criteria under evaluation	A.C.	Cae	Det	M.E.	N.P.
Are citizens notified of the unavailability of the use of the application?	N/A	N/A	N/A	N/A	N/A
Is the desired format of completion shown on the form?	No	No	No	No	No
Are the form fields filled out with only the required number of characters?	No	No	No	No	No

A.C.(Alerta Cidadão), Cae (Caern), Det (Detran), M.E. (Matrícula Escolar RN-SIGEduc) and N.P. (Nota Potiguar),  
N/A: Not Assessed

Source: developed by the authors.

Therefore, the two criteria to be analyzed in this guideline asked, respectively, whether “Is the desired format of completion shown on the form?” and whether “Are the form fields filled out with only the required number of characters?”. These criteria were not met by any of the applications under evaluation. Based on these responses, it can be seen that the applications being studied are not responsible for showing to the citizens the type and form of data required for the execution of the services, and that the fields in the forms have more space than necessary for filling out the requested information, which can lead to errors when filling out the forms and, consequently, make it impossible the proper provision of the the service.

The next guideline to be evaluated was “Design”, as shown in Table 9.

Table 9  
Design Guideline

Criteria Under Evaluation	A.C	Cae	Det	M.E.	N.P.
Are the application pages standardized?	Yes	Yes	Yes	Yes	Yes
Is information available in the application grouped and hierarchized by order of relevance?	No	Yes	Yes	No	No
Does the background of the application pages undermine its purpose?	No	No	No	No	No

A.C.(Alerta Cidadão), Cae (Caern), Det (Detran), M.E. (Matrícula Escolar RN-SIGEduc) and N.P. (Nota Potiguar)

Source: developed by the authors.

Here, the first question was whether “Are the application pages standardized?”. All applications met this criteria. This finding is better than that obtained by Lara et al. (2018), who found that 90% of the apps under evaluation had visual standardization. The next question asked whether “Is the information available in the application grouped and hierarchized by order of relevance?”. Here, the applications Alerta Cidadão, Nota Potiguar and Matrícula Escolar [School Enrollment] RN-SIGEduc did not meet this requirement. To this end, this answer can be illustrated with the example of School Enrollment RN-SIGEduc, whose main purpose is to carry out enrollments in the state education network. The enrollment calendar, however, is the information that appears last on the application's home page, refuting the purpose of this criteria, given that its intention is to “group the different types of information, presenting the most important ones first” (Brazil e-Gov Standards, 2010, p. 22). In short, if the main role of this application is to enroll students in the state education network, the enrollment calendar should be the first information to be provided to its users.

Finally, the question was asked whether “Does the background of the application pages undermine its purpose?”, which was not met by any of the applications, indicating that the design of the apps under study was conceived with the idea of seeking to meet their purpose first, prioritizing their user, given that the design aims to benefit the citizen during use, giving information the leading role in its relationship with design (Brazil e-Gov Standards, 2010).

The sixth guideline under analysis was “Writing Style”. It assessed the communication established between the application and its users, when providing government services and information (Brazil e-Gov Standards, 2010), as shown in Table 10.

In this guideline, all applications met the three requirements, which were: “Is the language used in the service provision clear and objective?”, “Is the title on the service provision page informative and visually appealing?” and “Is text on the service provision page spelled correct?”. The unanimous assessment allows us to understand that all the applications under study provide a language with sufficient clarity and purpose to allow for a plausible dialogue between the citizens and the electronic service accessed, taking into account that the priority of this guideline is to “speak people's language, with familiar words, phrases and concepts” (Brazil e-Gov Standards, 2010, p. 26).

Table 10  
Writing Style Guideline

Criteria under evaluation	A.C.	Ca e	Det	M.E.	N.P.
Is the language used in the service provision clear and objective?	Yes	Yes	Yes	Yes	Yes
Is the title on the service provision page informative and visually appealing?	Yes	Yes	Yes	Yes	Yes
Is text on the service provision page spelled correctly?	Yes	Yes	Yes	Yes	Yes

A.C.(Alerta Cidadão), Cae (Caern), Det (Detran), M.E. (Matrícula Escolar RN-SIGEduc) and N.P. (Nota Potiguar)

Source: developed by the authors.

The data from the last guideline being examined, “Consistency and familiarity,” are presented in Table 11.

The first question asked whether “Is the application’s structure focused on the services provided to citizens?”, and the positive reply was unanimous. Next, the question was “Is there any difficulty navigating the application’s functions?”, and the positive reply was also unanimous. Finally, the question was “Does the application’s contact hyperlink refer citizens to a form?”. In this case, only the Caern, Matrícula Escolar RN-SIGEduc, and Nota Potiguar applications met this requirement.

Table 11  
Consistency and familiarity Guideline

Questions under evaluation	A.C.	Cae	Det	M.E.	N.P.
Is the application’s structure focused on the services being provided to the citizens?	Yes	Yes	Yes	Yes	Yes
Is there any difficulty navigating the application’s functions?	No	No	No	No	No
Does the contact page hyperlink refer citizens to a form?	No	Yes	No	Yes	Yes

A.C.(Alerta Cidadão), Cae (Caern), Det (Detran), M.E. (Matrícula Escolar RN-SIGEduc) and N.P. (Nota Potiguar)

Source: developed by the authors.

The unanimous response to the first question indicates that all the applications under analysis were designed to meet the demand(s) of their users, focusing on providing activities

consistent with the needs of the audiences they are aimed at, being structured under the logic of their interests or their everyday events (Brazil e-Gov Standards, 2010).

The unanimity of the second question under analysis refers to the same logic as the previous question, as there were no difficulties navigating the applications, showing that users' navigation manifests itself in accordance with their experience, with their daily skills, contemplating “the citizens’ expectations and habits” (Brazil e-Gov Standards, 2010, p. 27).

The third question examined showed that only the Caern, Nota Potiguar and Matrícula Escolar [School Enrolment] RN-SIGEduc applications display a form to the citizens when the application's contact hyperlink is clicked. However, in each of the three applications the form is displayed differently.

In the Caern application, when accessing the home tab, the “Ombudsman” section appears as the penultimate item, which, once clicked, displays an additional mini window, in which users are asked which web browser they wish to use to open the contact page. After choosing the browser, the CAERN ombudsman page opens on its institutional website, containing a brief explanation about that relationship channel, with users initially being asked if they wish to file an accusation, compliment, complaint, suggestion or request. After choosing the subject to be dealt from amongst the available alternatives, users must tap the “next” key, just below the set of alternatives, to open up a new page and thus effectively begin filling out the form for contacting the agency.

This is an operation that takes users to an environment external to the application environment, which may compromise the very nature of this guideline, as the operator's interaction with the new page accessed differs from the context found in the application, requiring the device to be used to have a web browser. Despite that, when the ombudsman page is opened, it already directs users to the type of relationship that will be established between them and the agency, apparently helping them to be served more effectively.

In the Nota Potiguar application, however, unlike the previous one, the contact page hyperlink is not easily found. In its home tab, which contains all the sections available for user access, no indication was seen that would initially refer to the contact page hyperlink, thus deviating from the fundamentals of the “Consistency and Familiarity” guideline. However, on the home tab there is the “Help” section, which, when clicked, takes users to five subsections – MY CPF, FAQ, TELS/LINKS, LEGISLATION and ABOUT. When clicking on the TELS/LINKS subsection, users are presented with communication channels in the form of information – telephone numbers and email addresses– and electronic address links, where the “VIEW THE SITE” hyperlink is found. When clicked/tapped, as in the Caern application, it opens up an additional mini window and asks users which is their preferred web browser to access the form. This access to the form is via the “Contact Us” page of the website of the Rio Grande do Norte State Tax Secretariat (SET/RN), where, as well as on the Caern application, users are directed to the type of relationship that will be established with the agency, also categorizing the type of user and the specific subject to be addressed.

In view of the above, it is possible to identify some similarities between the two applications, such as taking users to an external environment; requiring that the device used has a web browser to allow access to the form; and sending users to the institutional website to access the agency’s contact page form and qualify the subject to be addressed in the form. However, the Nota Potiguar application differs from the Caern application, as it presents several electronic address links for contacting the user, whether on the SET/RN website or social networks, which do not provide a form.

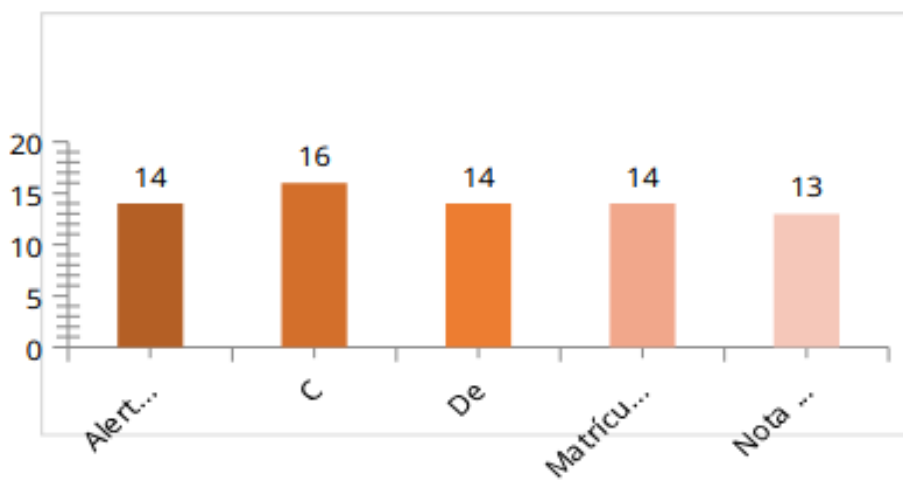
However, although both applications display contact page hyperlinks that send the operator to a form with the intention of making them communicate with the agency, this practice conflicts with the guidelines under analysis, as this format of making the form available through a hyperlink “incurs the opening of a program, which can take time and mislead the person” (Brazil e-Gov Standards, 2010, p. 29), which can make it impossible to establish a communicative link between citizens and the desired agency.

In the School Enrollment RN-SIGEduc application, when opened, users identify six sections with the application's functions. Of these, the first five deal with enrollments in the state education network and, in the last, there is the function “Access SIGEduc: all other SIGEduc functionalities”. When clicking on it, users are taken to a new page, where eight subsections can be seen – Schools, Enrollment, Pronatec, Selection Process, Events, Education Monitoring, State Education Plan and others. When clicking on the “others” subsection, seven items are displayed relating to the provision of services and information to users. Among them is the item “Get in touch: send your suggestion, complaint or criticism regarding your school by contacting the ombudsman”. When clicking this item, a new page opens up, initially displaying a frame in which users are informed of the Ombudsman’s role and which fields in the form must obligatorily be filled out. Just below this frame is the form, whose mandatory fields are name, email address, subject category, subject, title and message. After filling in at least these fields on the form, the user's statement can be sent to the Ombudsman.

In comparison with the other applications, the Matrícula Escolar [School Enrollment] RN-SIGEduc application displays, as a similarity, the typification of the subject to be addressed between the user and the agency. However, the application differs from the others by complying with the “Consistency and familiarity” guideline in the aspect under analysis, providing users with a form, in the application itself, through the contact page hyperlink, not requiring the opening of web browsers or taking operators to an external environment, thus strengthening the communicative link between users and the agency, as it prioritizes the app's exclusive relationship channel.

After the above, a graph was created showing the classification of applications in relation to the criteria adopted in the evaluation, as seen in Figure 1.

Figure 1  
Amount of criteria met by the application



Source: Developed by the authors.

In the graph it is possible to observe that among the 20 questions under examination, the Caern application meets the largest number of criteria, as it satisfies 16 of them, being followed by Alerta Cidadão, Detran and School Enrollment RN-SIGEduc, which meet 14, and in last place is Nota Potiguar, meeting 13 criteria.

This result, it seems, shows positively a certain balance of the applications under analysis in terms of usability, unlike the results obtained by Lara et al. (2018) and by Schneider et al. (2018), who identified more discrepancies and negative evaluations of the applications being studied. It is important to report, however, that, although the usability of these applications has been evaluated, the evaluation protocols used in the present study differ from the studies mentioned here.

In the study presented here, the result obtained by the Caern application can perhaps be explained due to its administrative nature, taking into account that, as it is a public company, it has a certain autonomy in relation to other agencies of the Rio Grande do Norte (RN) government, leading it to maintain in its administrative structure a systems development unit together with the Information Technology Management, which is part of the company's Planning and Finance Directorate, where the responsibility of this unit is to produce applications, web services and other information systems to directly serve citizens and the company itself.

## **Final Considerations**

Usability is a concept of clear relevance when it comes to mobile government. In view of this, the study sought to analyze the Rio Grande do Norte (RN) applications aimed at citizens and made available in the Play Store on the Google Play platform based on the federal government document, aiming to identify which applications comply with the booklet and verifying which of these exhibit more usability when serving citizens. Thus, the study showed that the five apps being evaluated meet between 65% and 80% of the criteria established in the methodology, where the Caern app stands out from the others for showing more usability with regard to citizen service, as it managed to meet sixteen of the twenty items under evaluation.

However, although the study has achieved its objectives, and the applications point to a satisfactory percentage of usability, it is possible to detect inconsistencies in the apps in relation to the criteria met and not met, such as, for example, the provision of a contact form through a hyperlink as seen in the Caern and Nota Potiguar applications, directing users to an environment external to the application, contrary to the question “Does the application's contact page hyperlink send citizens to a form?”, and the enrollment calendar being the last information to be displayed on the home page of Matrícula Escolar RN [School Enrollment RN], taking into account that, as it is extremely important information for the purpose of the application, it should be displayed before the others, but it is displayed last, opposing the question “Is the information available in the application grouped and hierarchized by order of relevance?” Consequently, these non-conformities compromise the level of usability available to citizens, given their essential nature which aims to guarantee adequate performance for the user.

The inconsistencies found in the applications being evaluated in the study reveal the state of Rio Grande do Norte's incipience in managing mobile government, requiring maturity to act in this field, signaling its inexperience in promoting this category of government action as a strategy for accessing the provision of public services, making its full development impossible and resulting in applications that have inadequate usability, which is a disadvantage to the citizens.

Thus, undermining the application's usability can frustrate the fulfillment of citizen's expectations, leading to recurring questions about the efficiency of Public Administration, which

directly conflicts with the e-gov objectives, taking into consideration that at the height of mankind's technological development, electronic government can be considered a revolution, not only as a result of the provision of public services remotely, whether through a smartphone or a personal computer, but with regard to the construction of citizenship for individuals, strengthening the State while promoter of public policies.

Nonetheless, this study demonstrates a certain methodological limitation, as it only analyzed, as criteria, the recommendations of the guidelines contained in the federal government's booklet that demonstrated accessibility, clarity and cohesion, disregarding other recommendations of a technical nature, which, if analyzed, could establish a different result from that which was obtained.

Given the results obtained, a suggestion is made for the continuation of the study, the establishment of two new methodologies, where in the first one the recommendations of the booklet that were discarded should be used as a methodological tool, the purpose of which is to perform a comparison of results, aiming to verify whether both modes of analysis present different results or whether it is possible to find the same conclusion. In the second, Jakob Nielsen's heuristics should be used as an analysis criterion, given that his recommendations were recurrent in the academic works cited in this study as examples of studies on the evaluation of usability in applications for mobile devices. It being selected is justified because it is an internationally recognized methodological approach, in addition to being widely used in research that seeks to examine usability in electronic government, whether in web portals or in mobile applications. Furthermore, future studies on this topic can analyze the perspective of service users.

Finally, the study proves satisfactory taking into consideration what was proposed in the objectives and what was obtained in the results. However, the inconsistencies found in some of the criteria analyzed raise the need for Rio Grande do Norte (RN) to readjust its applications, consulting references and good usability practices at national and international levels, adopting models that prioritize the user, including the possibility of expanding the logic of m-gov to other types of its services, reorganizing its back-office service from this perspective, making it more accessible and simplified from a smartphone or other portable electronic device for remote access, in addition to making it more stimulating for citizens to use it whenever they need or wish to do so.

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