Best Practices and Methodologies to Promote the Digitization of Public Services Citizen-Driven: A Systematic Literature Review

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Abstract: Governments at all levels have a mandate to provide services, protect society, and make the economy prosper. While this is a long-term goal, citizens are now expecting greater and faster delivery of services from government. This paper presents a systematic literature review of service digitization carried out by the governments of several countries, which was motivated by the lack of primary studies in the literature related to the identification of the processes and methodologies adopted by these governments and private companies to provide their services to the citizen. This work also contributes to the identification of best practices, technologies and tools used for the provision and evaluation of digitized services provided and how governments are evaluating the gains from digitization. These results of this systematic literature review serve as inputs to guide current and future research of the Brazilian Government in the construction of a digital platform for the provision of its services directed to the citizen, seeking to analyze their needs and improving the services currently provided.

Keywords: service digitization; government services; digital government; digital governance strategy; citizen-driven

1. Introduction

Service digitization has emerged as a way to provide more efficiency, effectiveness and quality [1] in government services, being able to reduce existing bureaucracy in the current processes [2].

Information and Communication Technology (ICT) is another/extensional term for Information Technology (IT) that stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals), computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information. However, definition, as the concepts, methods and applications involved in ICT are constantly evolving on an almost daily basis. The broadness of ICT covers any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form, for example, personal computers, digital television, email, robots. ICT can help in this bureaucracy reduction, providing ways to simplify procedures and mechanisms, through, among other forms, routine automation [2].

These days, most governments have a renewed focus on citizen happiness and engagement, and a well-planned digital government environment offers greater opportunities for building collaborative and participatory relationships among all relevant stakeholders [3].

In the case of public services, there are attempts to make access universal, in other words, available to all citizens regardless of income, education level, geographical location or access conditions to

technological resources [1]. Providing services under such conditions is a challenge for governments around the world. The major trends fueling the public sector are driven by rising citizen expectations, which in turn drives four key aspects:

- Pressure to deliver for more consumer-like citizen services;
- Need to refocus resources in areas that boost government program delivery and make it visible to citizens;
- Drive to improve citizen outcomes and install a government culture of service excellence and accountability;
- Necessity to diversify the economy, attract and nurture new businesses utilizing new business models under the umbrella of government as a facilitator.
- Strengthening of public-private partnerships as a way of increasing access to digitized services.

Driven by these pressures, government objectives cannot be limited to just the introduction of digital technologies and process automation within departments. It goes far beyond that, requiring a focused effort on digitally engaging citizens to modernize the public sector as a whole.

A key measure of success by modern countries is the level of engagement that their people undertake with their government. As the OECD (Organization for Economic Cooperation and Development) [4] states, good decision-making requires the knowledge, experiences, views, and values of the public, and unless citizens themselves understand and are engaged in the decision-making, trust is easily lost.

There are several benefits to citizens driving public policy reform and modernization as part of a digital government transformation. Citizen engagement drives the success of e-government, or digital government, by increasing the acceptance and uptake with the government through digital channels. This helps departments scale up services while reducing cost without compromising sustainability. It improves governance and creates a more informed government. This marks the shift in viewing citizens as customers of the government rather than subjects, which dictates a higher degree of interaction and engagement.

Engaged citizens can make important contributions to policies and programs related to every aspect of city life and government services. It reinforces government success by introducing a critical and honest feedback mechanism, building public trust in their leadership [5].

With regard to Brazil, the government has sought to encourage its Agencies to transform their digital services for access, sharing and monitoring of information, registration of demands and requests for official documents. The main objective of the Brazilian Government is to have a Digital Government From Citizen-Centric To Citizen-Driven, modernizing all public services.

Since 2016, important decrees have been published in this sense, defining a Digital Governance Policy [6] and the Digital Citizenship Platform [7] in the scope of the Federal Public Administration.

The Digital Citizenship Platform [7] aims to broaden and simplify the access of Brazilian citizens to digital public services, including through mobile devices. The Federal Government Service Portal should be a single integrated channel for the provision of information, electronic request and monitoring of public services, whose objective is, in addition to providing practicality and agility for citizens and entrepreneurs, for digital services to reduce the cost to government by up to 97%.

It is expected that the reduction will eliminate the unnecessary commuting costs of the government service, as well as waiting time in the queues, possible printouts of certificates, and document endorsements. The actions of the Platform are aligned with the Digital Governance Strategy (DGS) [8,9] that will guide the actions of ICTs of the Brazilian Government until 2019.

It is necessary to identify tools that measure the reach of the services not scanned in Brazil, to assist in the implementation and expansion of the services provision. These tools can help to increase citizen participation in the use of current services and even in the development of new services. Tools for pricing the costs of all these operations, still need to be studied and/or even developed.

This paper presents a systematic literature review about the digitization of Government services. Its main contribution is to identify in the literature how the governments of other countries are promoting the automation and digitization of their public services, as well as to present the best practices adopted for the process of government automation and digitization. In addition, it presents the registry of the technological solutions adopted in the processes used by success cases.

The remainder of this paper is organized as follows. Section 2 presents the research methodology adopted, the protocol and the result of the systematic literature review. In the Section 3 the results and the discussions are presented. Section 4 presents the proposed model. The conclusions and future work are presented in Section 5.

2. Research Methodology

The research methodology used in this study was the Systematic Literature Review (SLR) proposed by Kitchenham [10]. SLR is a way of identifying, analyzing and interpreting available evidence related to a particular research question, area or phenomena of interest [10,11]. Studies that contribute to a systematic review are called primary studies. A systematic review per se is a form of secondary study [10].

2.1. Systematic Literature Review

Systematic Literature Review (SLR) is a secondary form of study that looks to identify and analyze research relevant to a certain research question. Among its characteristics, we can highlight [10]:

- It has a review protocol that is defined at the start of the research. This protocol defines the research questions to be approached, and which methods will be used during the research;
- It proposes the creation of a well-documented research strategy. This strategy needs to be good enough to get the highest amount of primary studies in literature relevant to the topic;
- It uses inclusion and exclusion criteria to evaluate the primary studies found.

During the SLR, the Planning, Conducting and Reporting phases of the results were followed [10,12,13]. The research protocol followed in this work is presented in Figure 1 with the phases and activities performed in each of the phases of the SLR. The flow between the activities performed occurred iteratively. The phases and activities include:
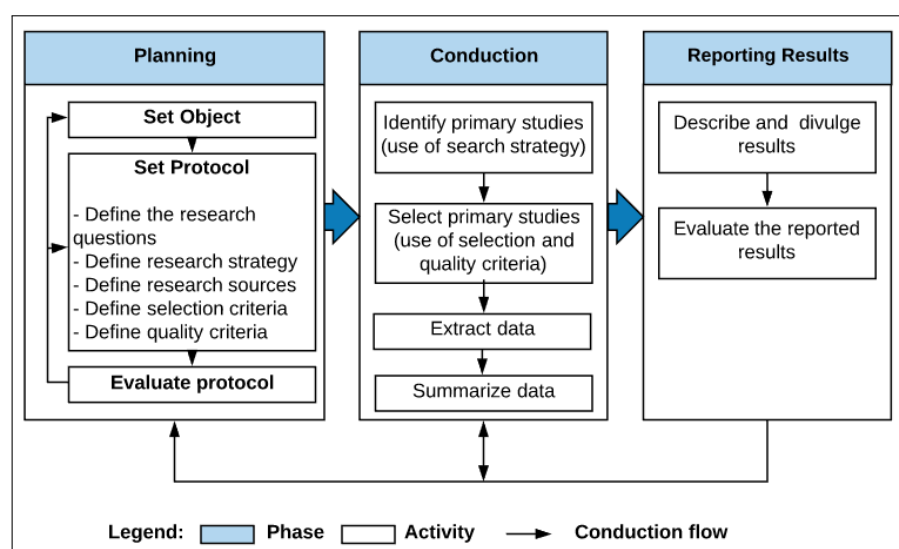

Figure 1. Phases and activities of the systematic review literature [11].

- **Planning**: The planning phase aims to identify the real need, namely the motivation to execute a SLR [11]. It is composed of the main activities of defining the objective and preparation of the protocol that will guide the SLR in order to minimize biases that can be committed by the researcher [12]. As well as the evaluation of this protocol, which in this work was carried out with the protocol test in one of the databases chosen for performing the automatic search.
- **Conduction**: During this phase of the SLR, the studies are identified through the application of the search strategy and selected according to the protocol defined in the planning phase. For the set of selected works, data are collected and synthesized in order to answer the research questions and thus facilitate analysis and synthesis for the creation of results [11].
- **Reporting Results**: The last phase of the SLR is related to the documentation of the SLR, where the description of the results must be executed, the answers to the research questions prepared and the results disseminated to the potential interested parties [12].

The tool StArt (State of the Art through Systematic Review) was used to support the performance of the SLR, assisting in the planning and conduction stages of the Systematic Review Literature.

The SLR was carried out with the objective of identifying and presenting the best practices and technologies currently adopted in the automation and digitization processes of services, as well as presenting guidelines on how to include automated and digitized processes in Brazilian federal public services.

2.1.1. Research Questions

The research protocol of Figure 1 was defined according to the methods, technologies and useful mechanisms to promote the automation and digitization of services. Thus, the Research Questions (RQ) were defined, which are presented in the Table 1.

Table 1. Research questions (RQ).

RQ	Description
RQ.1.	How to promote the automation and digitization of federal public services in Brazil?
RQ.2.	How to include in the automation process and the digitization of public services the citizens and agencies that provide the services?
RQ.3.	Which are the best practices adopted for the automation process and digitization of public services?
RQ.4.	What technological solutions are adopted in the automation processes and digitization of public services?

2.1.2. Search Strategy

The search strategy involved the use of Automatic Search [14], which consists of searching through the Search String in the electronic databases, followed by the Manual Search [14], through which searches were performed for works in conferences, newspapers or magazines.

The Automatic Search was performed in the following databases: Digital library ACM; Digital Library IEEE Xplore; DBLP-Computer Science Bibliography.

The Manual Search activity was performed in the Annals of the Conferences and Periodicals specific to the e-government area, as presented in Table 2:

Table 2. Addressed journals and conferences in manual search.

Initials	Conference/Journal
ICIS	International Conference on Information Systems
AMCIS	Americas Conference on Information Systems
ECIS	European Conference on Information Systems
JSIS	The Journal of Strategic Information Systems
DG.O	International Conference on Digital Government Research
EGOV	International Conference on Electronic Government
IJEGR	International Journal of Electronic Government Research

2.1.3. Search String

The definition of the search *String* was prepared according to the set of criteria PICO [11,13,15], which consists of: P-population. The population corresponds to a specific role within the lifecycle of the research focus, an area of application, or even a specific group of the industry; I-intervention, delimits the research focus within a broader scope; C-comparison, identifies alternatives and compares with the delimitation performed in the intervention; and O-outcomes, lists what is intended to be achieved, measured, improved or affected in relation to the population.

Delimitation of PICO criteria for this work is presented below.

- **Population**: The defined population was the automation or digitization of services. To search the population, the keywords digitization, automation, delivery and service were used.
- **Intervention**: The intervention aimed to identify and present the most relevant methods, technologies and mechanisms to promote the automation and digitization of services. For this, the following keywords were used: methods, technology and mechanism.
- **Comparation**: The focus of the study did not cover comparative studies, so this technique was not used in the search strategy and in the formation of the search string.
- **Result**: Work was done on services provided by governments, as well as on participation or participation by citizens. Thus, papers that included key words: citizen, e-participation and e-government were evaluated.

From the definition of these criteria the following search string was defined:

((DIGITIZATION OR AUTOMATION OR DELIVERY) AND SERVICES) AND (METHODS OR TECHNOLOGIES OR MECHANISMS) AND (CITIZEN OR E-PARTICIPATION OR E-GOVERNMENT).

2.1.4. Selection Criteria (Inclusion and Exclusion)

The following selection criteria were defined for the selection of primary studies:

1. The paper must be available in the previously defined digital databases.
2. The year of publication of the studies should be between 2007 and 2018. However, classical sources with definitions (books with classical concepts or pioneering articles) were also considered. The defined period of 10 years was identified as suitable for work selection, according to important research guides in the area of software engineering [11,13,15–20].
3. The study must have been written in English or Portuguese.
4. The study should propose or evaluate methods, technologies or mechanisms of digitization or automation of services.
5. The work must relate to both services provided by governments, as well as to participation or realization by citizens.
6. The work is classified as gray literature, that is, it is technical reports, preliminary studies, technical specifications, official documents of specific organs [11].

As criterion of exclusion of the studies was considered the non-fulfillment of some of the inclusion criteria, as well as:

1. In the case of incomplete works - published as Short Paper.
2. Do not present sufficient information to extract the expected data, thus impairing the quality or relevance of the work [16].

2.1.5. Quality Criteria

The evaluation of the quality of the studies identified after the execution of the search strategy allowed the selection of the most relevant articles to compose the SLR, being executed through the 4 stages of selection of studies defined by [14], which are presented in Figure 2.
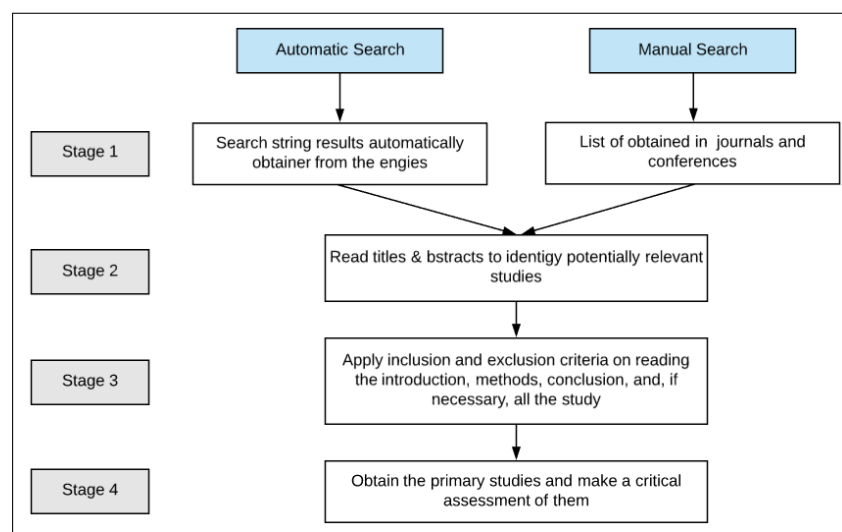
Figure 2. Stages of the paper selection strategy [14].

The stages adopted in the search strategy were:

1. Execution of search strategy involving automatic and manual searches. Thereby, a preliminary list of studies is generated, with the help of the StArt tool, it was possible to discard the duplicate works.
2. Identification of potentially relevant studies, based on reading the title and abstract. In this stage it is possible to discard studies that are clearly irrelevant to the research. In case of doubt about the permanence of any study in the SLR, the next stage assists in this definition.
3. Reading of the introduction, methodology and conclusion of the pre-selected works, again applying the inclusion and exclusion criteria.

The papers that were selected in stage 3 should be read in full and the volume of articles resulting from this stage will be used to compose the SLR and support the answers to the research questions.

2.1.6. Evaluation of the Adopted Research Protocol

To finish the planning activity of the Systematic Review Literature, the adopted protocol was tested through the execution of a pilot in the Digital Library ACM. With the execution of this activity, it was expected to evaluate the reach of the search string, and the result obtained was considered satisfactory and no adjustments were identified to be performed in the defined protocol.

While conducting this SLR, search activity was documented to ensure transparency and enable readers to verify its completeness and comprehensiveness [10]. The activities are described in the next sections. The SLR process may be reproduced or audited, if necessary.

2.1.7. Selection of Primary Studies

The automatic selection process of the primary studies was started by executing the search string in the digital databases. The automatic search in the 3 bases defined results in a total of **727 articles**, as shown in Table 3. It is important to note that only 6 papers were identified as duplicates, and the occurrence of duplicity occurred on the basis of Digital library ACM and Digital library DBLP.

Table 3. Publications filtered at the digital library.

Digital Library	Publications	Percentage
ACM	354	49%
IEEE Xplore	255	35%
DBLP	118	16%

The Figure 3 presents the evolution of the steps adopted in the selection strategy, which were applied in the papers identified during the automatic search.

The manual search performed in the Annals of Conferences and Periodicals determined in Table 2 and also represented in Figure 3 (by green points) was performed through various combinations of the search string defined in the protocol. This variation of the String was necessary because the bases of the Conferences and Periodicals have a smaller volume of publications and using the complete String often no work was identified.
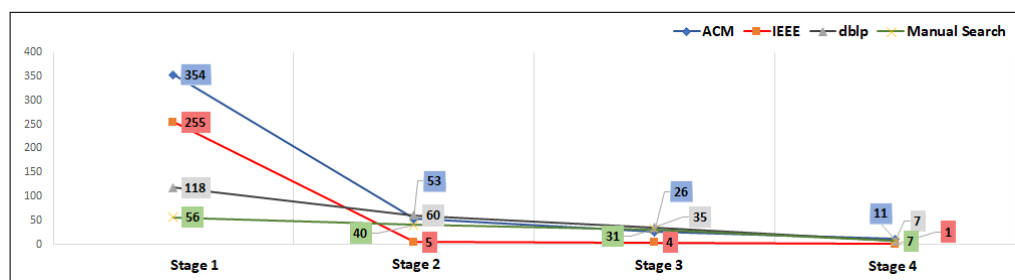
Figure 3. Evolution of the selection of works by digital base in the manual and automatic search.

The manual search resulted in a total of **56 articles** (Figure 3), which followed the stages defined in the adopted protocol, adding **783** articles in stage 1 (Figure 3). The evolution of the selection of these in the systematic literature review (SLR) is presented on the Table 4.

Table 4. Evolution of the work selection strategy.

Adopted Strategy	Stage 1	Stage 2	Stage 3	Stage 4
Automatic Search	727	118	65	19
Manual Search	56	40	31	7
Total Selected Primary Studies	**783**	**158**	**96**	**26**

After the final application of all stages of the work selection strategy, a total of **26 articles** (Figure 3) were identified to be used in data extraction. The evolution of the resulting work at each stage of the paper selection strategy accumulated per year of publication is presented in Figure 4. According to Figure 4 it is possible to identify that the number of publications involving the subject digitization of services is in a phase of growing interest by researchers, with a considerable increase in the number of publications between the years 2016 and 2017.
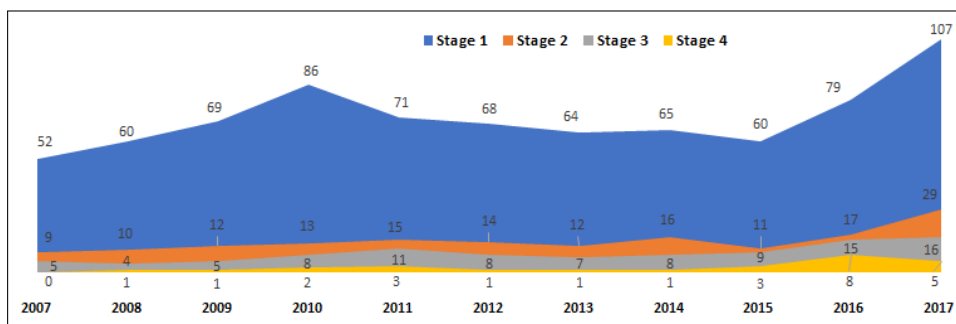
Figure 4. Number of papers selected in each stage of the selection strategy by year.

2.2. Data Extraction

Data extraction began with the export of bibliographic files in the BibTex format originated with the execution of the search strategy. These files contained information such as: title of the work, authors, year of publication, classification of the document, place of publication, number of pages and abstract.

The summary was made available together with the BibTex file only in the IEEE Digital Library, in the other search sources, the abstract had to be added through the individual research of each work.

With the development of the work until reaching stage 3 of the search strategy, where it was necessary to download the papers for complete reading and finalization of the selection, data extraction was performed with the functionalities of "Study Data" and "Selection Data" of the StArt tool.

It was necessary to carry out the complete reading of the articles to finalize the final selection of studies to compose the SLR. "Data Extraction Form" functionality of the StArt tool was also used, where the contributions of the works were recorded, as well as the information selected to be inserted in the synthesis of the answers of the research questions.

3. Results

Applying the search strategy, we identified a total of 783 papers. This comprises 56 papers from manual search and 727 papers from automatic search (Figure 3). Two researchers read title, abstract and keywords of the papers, and the application of selection criteria produced a list of 96 primary study candidates. Another researcher decided on disagreements in this task. The candidates' list was refined through the full papers reading and the application of exclusion criteria. As result of the whole screening process, depicted in Figure 5, this **research identified 26 primary studies**.
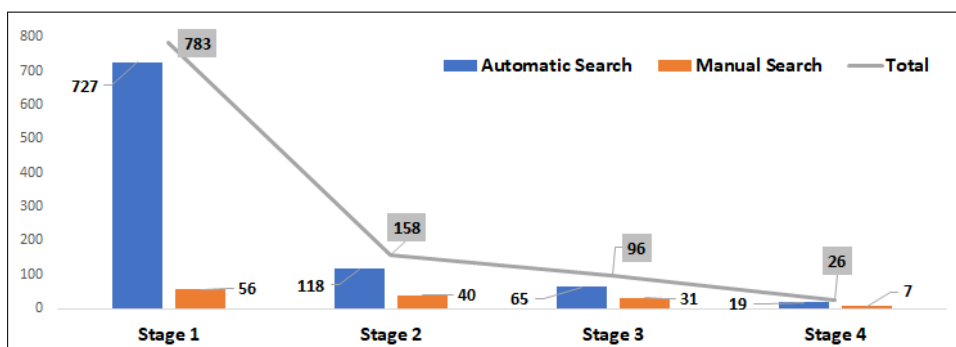

Figure 5. Number of papers selected in each stage of the selection strategy.

The data extraction occurred in all 26 articles selected in the last step of the strategy defined in the protocol of this research. From the complete reading of these articles presented in Table 5 it was possible to answer the research questions.

Table 5. List of Selected Articles in SLR and Research Questions Answered.

ID	Reference	Description	Research Questions
S1	[21]	Analysis of factors affecting the implementation of e-government to obtain quality services through the use of evaluation and measurement methods.	RQ.1
S2	[22]	Strategies for integrating E-government and E-governance.	RQ.1
S3	[23]	It seeks to understand citizens' satisfaction with the quality of services provided by SMS.	RQ.1
S4	[24]	Identifies and describes new channels for communication with citizens.	RQ.1
S5	[25]	Analyzes the implementation of service kiosks for the provision of federal and municipal public administrative services.	RQ.1 and RQ.4
S6	[26]	Evaluates the factors needed to attract citizens to use digitized services.	RQ.1, RQ.2 and RQ.3
S7	[27]	It presents a system concerned with security and secure data sharing, using a 3 layer structure and making use of combined technologies.	RQ.1, RQ.2, RQ.3 and RQ.4
S8	[28]	It presents ways of mining social media texts to broaden citizen participation in the development of better digitized services.	RQ.2
S9	[29]	Identifies factors that encourage citizens to use digitized services.	RQ.2
S10	[30]	It indicates how to include the citizen as a partner of government activities, contributing with time, experience and effort to reach positive results.	RQ.2
S11	[31]	Relates important factors to increase citizen participation in the development and use of digitized services.	RQ.2
S12	[32]	Does the analysis of how the citizen can be included in the process of transformation of public services.	RQ.2
S13	[33]	Proposes the use of open data to influence service delivery, increase stakeholder feedback, and analyze the impact of the use of such services.	RQ.2
S14	[34]	Demonstrates the application of gamification techniques to broaden citizen engagement.	RQ.2
S15	[35]	It suggests how to introduce gamification to involve citizens in the process of ideas of new types of services to assist in the elaboration of new concepts of digital services.	RQ.2
S16	[2]	It demonstrates the importance of reducing the bureaucracy of processes and automating them even before the application of technologies to provide services.	RQ.2 and RQ.3
S17	[36]	It proposes an innovation structure for the digital public service.	RQ.3
S18	[37]	It presents a way to produce information according to the profile of the reading public.	RQ.3
S19	[38]	It proposes to carry out the evaluation of the satisfaction degree of the citizens with regard to the digitized services.	RQ.3
S20	[39]	It guides strategic planning in order to meet the demands and implementation of services.	RQ.3
S21	[40]	It presents good practices used by the Georgian government in providing digitized services.	RQ.3 and RQ.4
S22	[41]	It proposes proxy authentication over time to increase the security of online transactions.	RQ.4
S23	[1]	Provides general guidelines for the provision of digitized services.	RQ.4
S24	[42]	Addresses the use of digital signature based on cloud for digitized services.	RQ.4
S25	[43]	Uses geo-visualization of information to increase citizen participation in digitized services.	RQ.4
S26	[44]	Describes the use of intelligent or multi-channel channels for citizen service.	RQ.4

3.1. RQ.1. *How to Promote the Automation and Digitization of Federal Public Services in Brazil?*

The deployment of government-digitized services requires more than technological sophistication, requires a shift in the mindset of public administration to citizen-centered service delivery [22].

The work presented by [21], highlights 5 key methods for the digitization of services by governments, being:

1. All citizens should be taken into account by promoting reliable, innovative and easily accessible services for all;
2. Efficiency and effectiveness must be a reality in the services provided, contributing to the high satisfaction, transparency and responsibility of users, relieving management and providing quality gains and resource savings;
3. The services implemented must start with the essential and high impact for citizens and companies. In order to identify such services, citizens and society must be included in the process of definition of scope and design;
4. Enabling elements should be added to services, enabling citizens and businesses to benefit from convenient, secure and interoperable forms of access;
5. Participation in developing ideas and choosing priorities should be democratic, using tools for effective public debate and empowering citizens and society in decision-making.

These key methods can be followed by the Brazilian government in order to allow the expansion and improvement of the digitized services provided. Other factors that may contribute to this process are:

- Analysis, measurement and quality assurance of the ways of making these services available. For this, the user's perceptions about technology, satisfaction and trust must be taken into account [26];
- Providing services tailored to the needs of each citizen, respecting their profile (which may be related to age group, educational level, economic situation and others) and from this determine the amount of information and the level of detail to be provided [37].

The choice of service delivery channels is another issue that should be widely evaluated by the Brazilian government to support the digitization of services.

Communication technologies have been evolving over the years, starting with traditional and personal communications, including options such as telephone and mail, reaching the use of the internet, social media and mobile phones with a wide variety of applications [44]. Artificial Intelligence techniques are also being inserted in this process, for example with the use of social and conversational robots that interact more and more with the citizens [44].

Currently, the most widely used means for delivering services digitized by governments and companies is the use of website portals, which deliver online services 24 hours a day in any part of the world, provided there is connection with internet [27]. Examples of services that can be offered by online portals are [27]:

- Access by the agencies of requests for information or needs of registered services;
- Requests for real estate or automobile registrations;
- Certificates and school records;
- Real-time monitoring by different bodies of citizen complaints (for example damaged roads, reports of violent crime or reports of missing children);
- Intelligent monitoring of natural disasters such as floods and landslides.

Other channels for providing services to citizens are:

- Mobile devices to access portals or service applications [27];
- Self-service kiosks that have the option of delivering official documents [25];
- SMS (Short Messaging Service) for the delivery of public services, mainly warnings and information, in order to maintain proximity, connectivity, interactivity and continuous communication with all citizens [23];

- Social Networks that has a fast and wide reach of the population when it is necessary to disclose urgent information. This channel can also be used to identify citizens' needs not formally expressed [24];
- Chat used as a way of asking the citizen's doubts about various issues [24].

3.2. RQ.2. How to Include in the Automation Process and the Digitization of Public Services the Citizens and Agencies That Provide the Services?

Deciding which services are to be deployed, identifying which services need improvement and finding out why some services do not have the expected volume of access are tasks that can only be performed if they have the joint involvement of citizens, society at large, public servants and decision makers of the provider of this service.

The inclusion of stakeholders in digitization is a good practice for the success of the process, since treating the citizen as a partner in government activities provides a number of contributions, such as: saving time, experiencing real need and great interest in achievement of positive results [5,30].

In addition, citizen participation enhances the transparency, confidence, acceptability and legitimacy of decisions taken by policy makers [28].

Some initiatives that seek for this greater participation of the citizen and of the own agencies in the process of automation and digitization of services are:

- In addition to the application of technologies, it should be taken into account in the provision of digitized services 3 main categories: (1) the ability of decision-makers to communicate constantly with implementers in order to deliver as well as obtain the right information when needed; (2) competence of decision-makers to assign responsibilities to implementers in order to reduce bureaucracy and allow greater agility between processes; and (3) the ability to define clear rules in the provision and use of services, which should be widely disseminated to all stakeholders [32];
- The use of open data may be conducive to increasing the transparency of processes and can also be used to identify new demands for services to be made available. Some examples to achieve this increase in value for citizens can be: 1. Through the analysis of the questions answered by the citizens during the use of the services [33]; 2. Identification of the most accessed information [33]; 3. The mining of data to identify information expressed by citizens in non-official media, such as the use of social networks [28,33];
- The gamification techniques can be used to involve citizens in the process of ideas of new types of services, helping in the elaboration of new concepts of digital services or improvement of existing services [35].

In addition to involving the citizen in the participation of the development of services, it is also important to identify ways in which citizens are more interested in using these services. Some examples are:

- Keep the information and forms of access centralized in a single point, in addition to automating and simplifying the processes in order to make the citizen more independent to meet their needs [2];
- Information portals, booklets or other means of disseminating knowledge should not be static, rather, they should be able to deliver personalized information to citizens with the volume of data and details appropriate to each profile [37];
- Realization of more investments in marketing, advertising and promotion of services, being through different channels and with various forms of access. This seeks to raise the level of awareness and knowledge of citizens regarding the services provided by the Government [28];
- Demographic and socioeconomic conditions such as gender, age, formal education, economic income and political attitudes are factors that must be raised and understood so that the services are adequate to the different profiles existing for citizens [31]. Systems and services should be

prepared to have user-friendly interfaces, adapting whenever possible to the profiles that have been identified [28];

- Providing public infrastructures, accessible and prepared to support the services offered, in order to guarantee availability and avoid access problems [28];
- Provide complete and high quality systems and processes, solving the needs of citizens in their entirety [28];
- Provide security and privacy of individuals and their data that must be kept intact and confidential [28];
- Gamification parts of the systems and services to thus involve and motivate the users to adopt the new processes with greater interest [34].

3.3. RQ.3. Which Are the Best Practices Adopted for the Automation Process and Digitization of Public Services?

In the provision of digitized services, it is not enough to provide countless services without understanding the real needs of citizens and the factors that influence the use of this type of service.

Among the factors that are pointed out as essential for the interaction of citizens with the digitized services, one can cite **quality, agility, privacy and security**, all those present at each stage of interaction between the interested parts [26]. It is worth emphasizing that quality must be present in different aspects, such as: **quality of the system, quality of service, quality of information, quality of content and product quality** [26].

The work presented by Bertot et al [36] complements the list presented by Akram and Malik [26], of the essential elements to be evaluated in the implementation of digitized services, which are:

1. **Infrastructure**: Digital infrastructure is a necessary prerequisite, including robust digital technology infrastructure within governments, between citizens and industry. Without connectivity, access to systems and service applications is not possible;
2. **Capacity**: Different capacities, including organizational, human, regulatory, collaborative and other, must be present in all governments, industry, communities and citizens. These capabilities are needed to leverage the digital technology infrastructure and broadcast digital innovations;
3. **Ecosystems**: Innovative services, empowered by governments, should be part of a broader social innovation ecosystem, facilitating cultural change to adopt a positive attitude towards risk and product acceptance;
4. **Partnerships**: While governments may face challenges with their ability to innovate, they can take advantage of the innovative capabilities and resources of partners. Developing the capacity to partner with the private and non-profit sectors and engaging citizens in defining new services are important mechanisms for delivering innovative public services;
5. **Inclusion**: If innovative services must be ubiquitous and benefit all, they need to be available and usable by everyone. Implemented innovations should ensure that all actors have the ability to use and benefit from these services;
6. **Value**: Innovations must offer public value and be valued;
7. **Delivery Channels**: Many factors, including age, preferences, digital literacy, infrastructure, among others, affect the acceptance of digital services and opportunities for citizens to get involved. Therefore, several service delivery channels are required for engagement as well as multichannel delivery strategies to decide the most appropriate channels for each service;
8. **Security**: Digital service innovations can not be deployed without ensuring the security of interactions and stored content;
9. **Privacy**: Security focuses on content protection, while privacy belongs to citizens' ability to opt out of digital public services. Innovations can not be mandatory, but citizens must retain the right to select the services they wish to receive, use or wish to engage with. For this to happen, privacy must be ensured;

10.　**Authentication**: Secure and verifiable authentication is required, but we also need appropriate authentication measures to ensure that the recipients of the service are indeed recipients. This requires layers of security and authentication across all services.

Other guidelines identified with the systematic review of literature as best practices in the implementation of digitized services are:

- Factors that may justify the low use of digitized services are the way services are delivered, trying to simulate processes that are already available, typically derived and conceived from human interaction, where citizen trust is generated from direct interactions with public officials. When developing services using ICTs (Information and Communication Technologies), it is important to keep in mind that access to a website or portal does not provide the same level of trust as personal services, so mechanisms that can help increase citizens' trust should be introduced into digitized services [38].

  It is not enough to implement a large set of services, it is necessary to monitor the use of these services, measuring citizen satisfaction and identifying improvements to be implemented in order to increase the engagement and use of services [38].

- Environments for the provision of digitized services must be formed by 3 layers, being: **1ª**—Web portal through which the citizen will interact, including flexible and adaptable tools; **2ª**—Electronic protocol system, which is an intermediate layer responsible for security mechanisms and infrastructure for the provision of services and **3ª**—System itself, where the functionalities to be made available are developed, tested and put into production [1].

  Organizations, including public and private, must create, maintain and follow strategic ICT planning to guide their processes, avoid unrealistic strategies with poorly designed action plans or lack of internal alignment [39].

3.4. RQ.4. What Technological Solutions Are Adopted in the Automation Processes and Digitization of Public Services?

The use of existing Information and Communication Technologies (ICT) is vital in the process of accelerating the digitization of services, providing services increasingly adapted to the individual needs of citizens, providing greater satisfaction and use of these services. This process is important for citizens, who will have access to a more convenient, preferable and economical form of interaction with public agencies. For governments, this approach is important because it allows for cross-departmental synchronization, decreasing queues, reducing response time and financial expenses [25].

New technologies arise at all times and are analyzed in order to identify benefits of their use in existing processes. One of the major concerns of governments and citizens' demands [27] is with respect to the security of the transactions and the data used in these operations. Some examples of innovative practices with respect to electronic government security are:

- SecureGov is a mechanism that has been implemented in Korea's Public Information Sharing Center (PISC). This system uses a layered security structure with combined technologies, including a usage control scheme called Enterprise Digital Right Management (E-DRM) to prevent the illegal use and leaking of data, a counterfeit prevention technology using a 2-D bar code to prevent illegal data modification and a Public Key (PKI) scheme to ensure the authenticity of the data [27].
- A prototype is being tested by the government of India in that the proposal is an integrated digital signature approach based on cloud computing to enable electronic authentication and data security in the transaction phase of digitized services [42].
- The Government of India also uses another mechanism involving the digital signature to perform authentication of the data through the temporary proxy signature, where the owner of the signature transfers the power of its use to a signatory authority during a specific period of time and any misuse of the resources is prevented through the signature key generation procedure [41].

- The government of Georgia has an exclusive department to deal with the cyber security of its digitized services, among its practices is the monitoring of the use of services and the volume of transactions carried out.

Governments also need to be concerned with mechanisms to prevent fraud in the use of digitized services, among the innovative technologies identified, we have:

- The government of Greece uses an online system for requesting services by citizens where the processing of the orders made takes place almost completely in an automated way, to reduce response time and minimize the need for human intervention, with the aim of avoiding fraud at any stage of the request process [1].
- The use of SmartGates, which are kiosks for citizens' recognition through the evaluation of biometric data and even the face [25] which are common at airports and customs for validation of documents such as passports, is already being tested by several governments, such as Russia, which in self-service kiosks allows the citizen to make requests for documents and makes their delivery using this technology [25].

Regarding the technological innovations that are being tested and/or used to support quality, agility and increased use of digitized services, it can be mentioned:

- The use of social robots to complement government communication channels with citizens is the option that brings together artificial intelligence techniques allowing richer service experiences that increasingly resemble human experiences. The use of these technologies lowers the burden on the organization and its human agents [44].
- The use of geo-visualization to aid in the understanding of data that has a spatial reference to them associated with technology that has been used to help citizens and rulers to more effectively understand information in a geographic environment and thus facilitate communication between these stakeholders for better decision-making. A simple example of the use of such technology is the decision to be made on a new cycleway to be deployed in a given city, with the use of geo-visualization citizens can suggest routes to be constructed [43].

Continued innovation in the provision of public services is essential to meet the diverse social needs, raising social aspirations, economic pressure and unequal conditions for the provision of public services within and between countries. The results of this systematic literature review allowed us to identify several Government initiatives with this intention and to establish a panorama for the needs of the Brazilian Government, considering the best practices that were identified [45]. In addition, a proposal for a model for the digitization of Brazilian public services was constructed.

3.5. Threats to Validity

We describe as follows the threats to validity of this systematic literature review, as well as mitigation strategies for each one:

- **Research questions**: the defined questions might not have covered the whole digital government and digitization services area. Thus, one may not find answers to the questions that concern him/her. As we considered this a feasible threat, several discussion meetings with the research team were held to calibrate the systematic literature review questions;
- **Subjectivity in the study selection**: we cannot guarantee that all relevant primary studies were selected. It is possible that relevant papers were not chosen. In order to mitigate it, we performed the automatic search, and complemented it by performing manual search to try to collect all primary studies in this field;
- **Subjectivity in the data extraction**: during the data extraction process, the primary studies were classified based on our judgment. In order to mitigate this threat, the classification process was performed using peer review;

- **Repeatability of the systematic process**: there is a risk involving the ability to replicate or extend this systematic literature review. This threat is mitigated through a detailed description of the systematic process in this work, since all details of the systematic literature review protocol were described. Moreover, we published the data extraction results on the Web as an additional source of information.

4. Proposed Model

With the accomplishment of the systematic literature review it was possible to answer the research questions that were elaborated to guide our research and to propose a digitization model to be tested by the Brazilian Government. Figure 6 presents the proposed model.

The model proposed to customize the services provided by the Brazilian Government needs to have the Process centered on the Citizen, where each phase represents the activities necessary to be executed. The first phase, for example, which is to customize it (Figure 6—The goal is to understand citizen), requires the following activities/tasks to be performed:
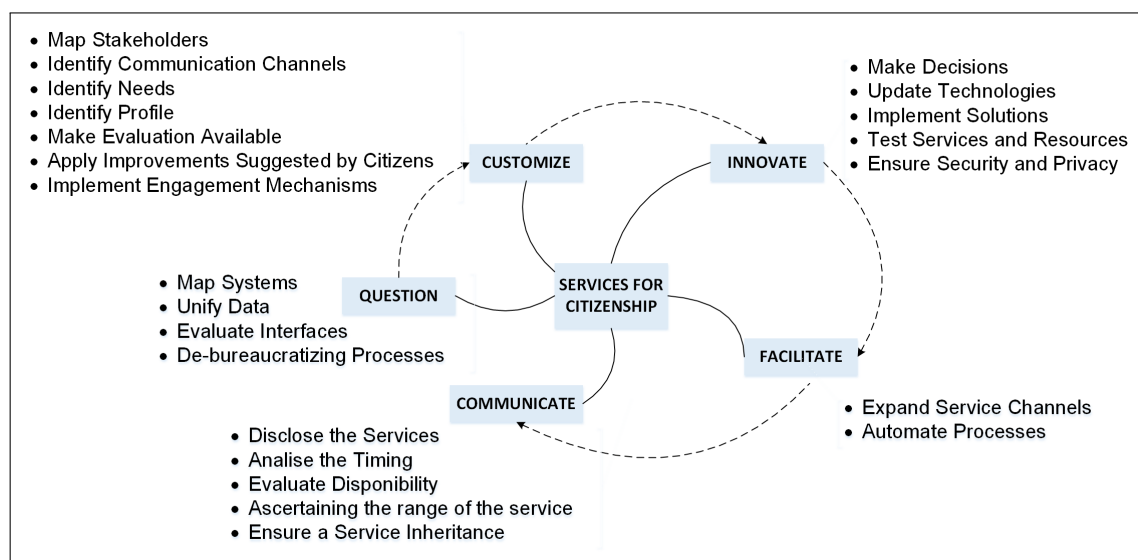

Figure 6. Proposed model for the digitization of services.

1. **Map the stakeholders**: Map the general outline and description of the different individuals, groups and organizations that interrelate, directly or indirectly, with each other.
2. **Identify the possible stakeholders**: Conducting a survey or interviewing citizens in a busy location.
3. **Identify communication channels**: Verify which communication channels will be used, and can be structured: surveys, interviews; formal unstructured: e-mail, chat; and informal: social networks.
4. **Identify needs**: Map and classify quantitatively the priorities of services and/or functionalities to be implemented.
5. **Apply techniques to identify the profiles of citizens**: Profiles related to age group, educational level, economic situation, among others, must be identified for delivery of the adequate volume of information. Profiles related to difficulty of access or deficiency (auditory or visual) should be identified to suit the way the service is delivered.
6. **Provide a tool to evaluate the services provided**: Services must be continuously evaluated to identify changes or improvements to be developed, access below expected, as well as to perceive infrastructure or security problems.

7. **Apply improvements in services provided**: Improvements or changes must be implemented to fit the perceptions of citizens.
8. **Implement mechanisms to maintain and/or encourage the use of services**: The citizen should be encouraged to use the services as if they were part of their daily life.

This model will be implemented in a federal government agency with the purpose of executing all activities of the customize phase, recording all the collected information, as well as the citizens' feedback regarding the proposed model. If the necessity for adjustments is identified at this stage, these adjustments will be made prior to the implementation of the complete model, in order to allow the other phases to be detailed and implemented with the aim to validate the model as a whole and especially the first phase that is important to understand the profile of the citizen who will consume the digitized services.

5. Conclusions

In this paper, a systematic literature review was performed to investigate the state-of-the-art in the digital government area. As the result of a combined automatic and manual search, 26 primary studies were identified. Four research questions of these studies were analyzed. The evidence from the research questions guided the identification of research gaps and incentives for future research.

The systematic literature review allows to find scientific papers on a particular subject and in this work it was identified several works related to the topic of service digitization. Among them, articles with the focus on Digital Government, main area of interest of our research.

From the articles selected in the last step of the review, it was possible to answer the research questions that were defined to guide this research and to identify the initiatives addressed by the countries that are at a more advanced stage than the Brazilian Government in the offer of its digitized public services.

Answering the research questions, it was possible to identify possible solutions to be used and/or customized by the Brazilian Government on how to promote the automation and digitization of its services. In addition, to validate the culture proposed by the Government that the citizen is part of the process, being essential its participation for the government to achieve a good and efficient digitization of its services.

This review also allowed to identify the best e-government practices currently used by other countries in their digitization processes of public services. These practices will be important in the choice of tools that will be adopted by Brazil in the process of establishing its Digital Citizenship Platform centered on the Brazilian citizen.

The technological solutions adopted in the digitization processes found in the literature will allow a reflection about the security mechanisms that the Federal Government should take into account when the Digital Citizenship Platform [7] to the Brazilian citizens, understanding the necessary actions to increase and improve the offer of digital public services.

It is well known that the digitization of public services requires several fronts and a comprehensive team in front of the process, with the purpose of offering quality services, safe and adherent to the needs of the citizen. Brazil is walking on this horizon and progress is being made in this direction.

It is necessary to propose a platform comprising all the necessary variables (phases and activities), with a coherent process to evaluate the maturity of the services and a correct pricing according to our scenario. Thus, this paper proposes from the answers of the research questions, a model of digitization of services centered on the citizen to the Brazilian Government with the tools and technologies used in cases of success in other governments. We plan to extend this study by undertaking a broader automated search for other systematic literature review about digitization of services centered on the citizen over the other time period.

As future work, from this systematic review, we will validate the service digitization model proposed in a Federal Public Administration Agency and make possible adjustments and/or improvements, in order to encourage citizen participation in the digital services offered.

References

1. Drigas, A.; Koukianakis, L. Government Online: An E-Government Platform to Improve Public Administration Operations and Services Delivery to the Citizen. *Lect. Notes Comput. Sci.* **2009**, *5736*, 523–532.
2. Cordella, A.; Tempini, N. E-government and organizational change: Reappraising the role of ICT and bureaucracy in public service delivery. *Gov. Inf. Q.* **2015**, *32*, 279–286. [CrossRef]
3. Roy, J. Open data and open governance in Canada: A critical examination of new opportunities and old tensions. *Future Internet* **2014**, *6*, 414–432. [CrossRef]
4. Committee, P.G. *OECD Recommendation on Digital Government Strategies*; OECD: Paris, France, 2014.
5. Patón-Romero, J.D.; Baldassarre, M.T.; Piattini, M.; García Rodríguez de Guzmán, I. A Governance and Management Framework for Green IT. *Sustainability* **2017**, *9*, 1761. [CrossRef]
6. Moura, M.A. Política de Governança Digital Brasileira: Em pauta a participação social e a transparência ativa. *Revista Ágora Políticas Públicas Comunicação e Governança Informacional* **2016**, *1*, 121–125.
7. Da Republica do Brasil, P. *Plataforma de Cidadania Digital—Decreto N. 8.936 de 19 de Dezembro de*; Platform for Digital Citizenship: New York, NY, USA, 2016.
8. Ministerio do Planejamento, G.E.D. *Estrategia de Governanca Digital*; MP: Lisbon, Portugal, 2016.
9. Musafir, V.E.N. Brazilian e-Government policy and implementation. In *International E-Government Development*; Springer: Berlin, Germany, 2018; pp. 155–186.
10. Kitchenham, B. Procedures for performing systematic reviews. *Keele UK Keele Univ.* **2004**, *33*, 1–26.
11. Felizardo, K.R.; Nakagawa, E.Y.; Fabbri, S.C.P.F.; Ferrari, F.C. *Revisão Sistemática da Literatura em Engenharia de Software: Teoria e Prática*; Elsevier: New York City, NY, USA, 2017.
12. Brereton, P.; Kitchenham, B.A.; Budgen, D.; Turner, M.; Khalil, M. Lessons from applying the systematic literature review process within the software engineering domain. *J. Syst. Softw.* **2007**, *80*, 571–583. [CrossRef]
13. Biolchini, J.; Mian, P.G.; Natali, A.C.C.; Travassos, G.H. Systematic review in software engineering. *Syst. Eng. Comput. Sci.* **2005**, *679*, 45.
14. Silva, F.S.; Soares, F.S.F.; Peres, A.L.; de Azevedo, I.M.; Vasconcelos, A.P.L.; Kamei, F.K.; de Lemos Meira, S.R. Using CMMI together with agile software development: A systematic review. *Inf. Softw. Technol.* **2015**, *58*, 20–43. [CrossRef]
15. Pai, M.; McCulloch, M.; Gorman, J.D.; Pai, N.; Enanoria, W.; Kennedy, G.; Tharyan, P.; Colford, J.J. Systematic reviews and meta-analyses: An illustrated, step-by-step guide. *Natl. Med. J. India* **2004**, *17*, 86–95. [PubMed]
16. Petersen, K.; Vakkalanka, S.; Kuzniarz, L. Guidelines for conducting systematic mapping studies in software engineering: An update. *Inf. Softw. Technol.* **2015**, *64*, 1–18. [CrossRef]
17. Cerchione, S.; Cerchione, R.; Singh, R.; Centobelli, P.; Shabani, A. Food cold chain management: From a structured literature review to a conceptual framework and research agenda. *Int. J. Logist. Manag.* **2018**. [CrossRef]
18. Kitchenham, B.; Pretorius, R.; Budgen, D.; Brereton, O.P.; Turner, M.; Niazi, M.; Linkman, S. Systematic literature reviews in software engineering—A tertiary study. *Inf. Softw. Technol.* **2010**, *52*, 792–805. [CrossRef]
19. Zhang, H.; Babar, M.A. Systematic reviews in software engineering: An empirical investigation. *Inf. Softw. Technol.* **2013**, *55*, 1341–1354. [CrossRef]
20. Wohlin, C.; Prikladniki, R. Systematic literature reviews in software engineering. *Inf. Softw. Technol.* **2013**, *55*, 919–920. [CrossRef]
21. Vaezi, S.K. Measurement and Evaluating Frameworks in Electronic Government Quality Management. In Proceedings of the 2nd International Conference on Theory and Practice of Electronic Governance, Cairo, Egypt, 1–4 December 2008; ACM: New York, NY, USA, 2008; pp. 160–165.

22. Qian, H. Global perspectives on e-governance: From government-driven to citizen-centric public service delivery. In Proceedings of the 4th International Conference on Theory and Practice of Electronic Governance, Beijing, China, 25–28 October 2010; ACM: New York City, NY, USA, 2010; Volume 444, pp. 1–8.

23. Shareef, M.A.; Dwivedi, Y.K.; Kumar, V.; Kumar, U. Reformation of public service to meet citizens' needs as customers: Evaluating SMS as an alternative service delivery channel. *Comput. Hum. Behav.* **2016**, *61*, 255–270. [CrossRef]

24. Valle-Cruz, D. Dynamic Interaction Between Emerging Technologies and Organizational Factors in Government Agencies. In Proceedings of the 9th International Conference on Theory and Practice of Electronic Governance, Hammamet, Tunisia, 1–3 March 2016; pp. 428–431, doi:10.1145/2910019.2910096. [CrossRef]

25. Aleksandrov, O.; Dobrolyubova, E. Public Service Delivery Through Automated Self-Service Kiosks: International Experience and Prospects for Implementation in Russia. In Proceedings of the 2nd International Conference on Electronic Governance and Open Society: Challenges in Eurasia, St. Petersburg, Russian Federation, 24–25 November 2015; pp. 205–210, doi:10.1145/2846012.2846048. [CrossRef]

26. Akram, M.S.; Malik, A. Evaluating Citizens' Readiness to Embrace e-Government Services. In Proceedings of the 13th Annual International Conference on Digital Government Research, College Park, MD, USA, 12–15 June 2011; pp. 58–67, doi:10.1145/2307729.2307740. [CrossRef]

27. Choi, J.J.U.; Ae Chun, S.; Kim, D.H.; Keromytis, A. SecureGov: Secure Data Sharing for Government Services. In Proceedings of the 14th Annual International Conference on Digital Government Research, Quebec City, QC, Canada, 17–20 June 2013; ACM: New York, NY, USA, 2013; pp. 127–135, doi:10.1145/2479724.2479745. [CrossRef]

28. Boudjelida, A.; Mellouli, S. A Multidimensional Analysis Approach For Electronic Citizens Participation. In Proceedings of the 17th International Digital Government Research Conference on Digital Government Research, Shanghai, China, 8–10 June 2016; ACM: New York, NY, USA, 2016; pp. 49–57, doi:10.1145/2912160.2912195. [CrossRef]

29. Lagzian, M.; Pourbagheri, M. An investigation into affecting factors on acceptance of e-government service counters as a service delivery channel: A case of developing country. In Proceedings of the 8th International Conference on Theory and Practice of Electronic Governance, Guimarães, Portugal, 27–30 October 2014; ACM: New York City, NY, USA, 2014; pp. 11–19.

30. Linders, D. We-Government: An Anatomy of Citizen Coproduction in the Information Age. In Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times, College Park, MD, USA, 12–15 June 2011; pp. 167–176, doi:10.1145/2037556.2037581. [CrossRef]

31. Ma, L.; Zheng, Y. Good Wine Needs Bush: A Multilevel Analysis of National E-Government Performance and Citizen Use Across European Countries. In Proceedings of the 17th International Digital Government Research Conference on Digital Government Research, Shanghai, China, 8–10 June 2016; ACM: New York, NY, USA, 2016; pp. 184–193, doi:10.1145/2912160.2912166. [CrossRef]

32. Omar, A.; Weerakkody, V.; Millard, J. Digital-enabled Service Transformation in Public Sector: Institutionalization As a Product of Interplay Between Actors and Structures During Organisational Change. In Proceedings of the 9th International Conference on Theory and Practice of Electronic Governance, Hammamet, Tunisia, 1–3 March 2016; pp. 305–312, doi:10.1145/2910019.2910080. [CrossRef]

33. Pereira, G.V.; Macadar, M.A.; Luciano, E.M.; Testa, M.G. Delivering public value through open government data initiatives in a Smart City context. *Inf. Syst. Front.* **2017**, *19*, 213–229. [CrossRef]

34. Alloghani, M.; Hussain, A.; Al-Jumeily, D.; Aljaaf, A.J.; Mustafina, J. Gamification in e-Governance: Development of an Online Gamified System to Enhance Government Entities Services Delivery and Promote Public's Awareness. In Proceedings of the 5th International Conference on Information and Education Technology, Tokyo, Japan, 10–12 Janurary 2017; pp. 176–181.

35. Kauppinen, S.; Luojus, S.; Lahti, J. Involving Citizens in Open Innovation Process by Means of Gamification: The Case of WeLive. In Proceedings of the 9th Nordic Conference on Human-Computer Interaction, Gothenburg, Sweden, 23–27 October 2016; ACM: New York, NY, USA, 2016; pp. 23:1–23:4.

36. Bertot, J.C.; Jaeger, P.T.; Gorham, U.; Greene, N.N.; Lincoln, R. Delivering e-government services through innovative partnerships: Public libraries, government agencies, and community organizations. In Proceedings of the 13th Annual International Conference on Digital Government Research, College Park, MD, USA, 4–7 June 2012; ACM: New York, NY, USA, 2012; pp. 126–134.

37. Colineau, N.; Paris, C.; Linden, K.V. Automatically generating citizen-focused brochures for public administration. In Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times, College Park, MD, USA, 12–15 June 2011; ACM: New York, NY, USA, 2011; pp. 10–19.

38. Corradini, F.; Polini, A.; Polzonetti, A.; Re, B. Business Processes Verification for e-Government Service Delivery. *IS Manag.* **2010**, *27*, 293–308. [CrossRef]

39. de Almeida Teixeira Filho, J.G.; de Moura, H.P. MMPE-SI/TI (Gov)—Model to assess the maturity level of the IS/IT strategic planning of Brazilian governmental organizations. In Proceedings of the PICMET '11: Technology Management in the Energy Smart World (PICMET), Portland, OR, USA, 31 July–4 August 2011; pp. 1–10.

40. Nielsen, M.M. eGovernance and Online Service Delivery in Estonia. In Proceedings of the 18th Annual International Conference on Digital Government Research, Staten Island, NY, USA, 7–9 June 2017; pp. 300–309, doi:10.1145/3085228.3085284. [CrossRef]

41. Bannore, A.; Devane, S.R. Use of Proxy Signature in e-Governance. In Proceedings of the Second International Conference on Information and Communication Technology for Competitive Strategies, Udaipur, India, 4–5 March 2016; pp. 82:1–82:6, doi:10.1145/2905055.2905141. [CrossRef]

42. Jain, V.; Kumar, R.; Saquib, Z. An Approach Towards Digital Signatures for e-Governance in India. In Proceedings of the 2015 2nd International Conference on Electronic Governance and Open Society: Challenges in Eurasia, St. Petersburg, Russia, 24–25 November 2015; pp. 82–88, doi:10.1145/2846012.2846014. [CrossRef]

43. Marzouki, A.; Lafrance, F.; Daniel, S.; Mellouli, S. The Relevance of Geovisualization in Citizen Participation Processes. In Proceedings of the 18th Annual International Conference on Digital Government Research, New York, NY, USA, 7–9 June 2017; pp. 397–406, doi:10.1145/3085228.3085240. [CrossRef]

44. Pieterson, W.; Ebbers, W.; Madsen, C.Ø. New Channels, New Possibilities: A Typology and Classification of Social Robots and Their Role in Multi-channel Public Service Delivery. *Lect. Notes Comput. Sci.* **2017**, *10428*, 47–59.

45. Canedo, E.D.; da Costa, R.P.; de Sousa Junior, R.T.; Amvame Nze, G.D. Best Practices Kits for the ICT Governance Process within the Secretariat of State-Owned Companies of Brazil and Regarding these Public Companies. *Information* **2018**, *9*, 141. [CrossRef]