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RESEARCH ARTICLE

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IDENTIFICATION OF ATTRIBUTES FOR EVALUATING THE CONTENT OF E-GOVERNMENT WEBSITES: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

In the last twenty years, e-government has become a strong complement to traditional public services. This study involved a systematic literature review to select studies enabling the identification of the attributes used to evaluate how content is delivered to users. The search strategy was limited to four databases to cover e-government multidisciplinary areas. The sources of information used were books, book chapters, conference papers, and articles in peer-reviewed journals, written in English or Portuguese, and which subjects included e-government research, published since 2000. The PRISMA statement has guided the research methodology. The lack of explanation of the role of the attributes found in the studies and the diversified terminology used, can be pointed as the main limitations of the study. On the other hand, since the interpretation was based on author past experiences and convictions, there may be a bias in the understanding of the less clear attributes with consequences on their description and the interpretation of similarities among attributes. The research resulted in the identification of 139 attributes, from which 56 are considered main attributes, and 83 similar attributes. Attributes such as quality, interface, content, information, user experience, usability, and accessibility appear as the most relevant.

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INTRODUCTION

E-government can be considered as the alignment of public services dematerialization with the needs of the citizens to access public services. Government websites or platforms must be inclusive, useful, and centered on users' needs, as a way to bring users and public administration (PA) closer (European Commission [EC] (2016); United Nations [UN], 2018: 29-46; Wang, 2014). The delivery of content by e-government and the way it is delivered play a central role in promoting this approach. Difficulties in the access to e-government, the content, or in understanding the information, may lead to set users away from technology and, in consequence, to make the interaction with the public administration difficult (Wang, 2014). Exploratory research of e-government mainstream reveals that the history of the use of technology for governments and PA began in the 1950s (Grönlund and Horan, 2005). Until the 1990s research linking government to technology could be found in the field of Information Technology (IT) and a few years later, with the advent of the

Communication Technologies (ICT) (Grönlund & Horan, 2005). The interest in this area started to grow in the nineties with the massive adoption of personal computers and with the advent of the Internet (Bannister and Grönlund, 2017; Scholl, 2012). The focus was oriented to government efficiency and the improvement of the democratic processes (Grönlund and Horan, 2005).

The emerging of new local and global phenomena, like market (de)regulation policies, the sustainability of public debt, the so called "third industrial revolution", the emerging of smart government and new participatory movements of citizens, may justify the impact of the adoption of technology by governments in modern societies (School, 2012).

Another evidence of the importance of e-government research is the increase of publications in the last two decades (Bannister and Grönlund, 2017). Researchers, governments, and non-governmental organizations have generated large contributions to evaluate the maturity of e-government, at the

2017). This approach was intended at evaluating the quality of the services offered (Fath-Allah *et al.*, 2014) and its implementation (Valdés *et al.*, 2011). Literature analysis points at a high level of conceptual similarity of these models (Fath-Allah *et al.*, 2014; Napitupulu, 2016; Zahran *et al.*, 2015). Maturity models vary from three to seven stages (Fath-Allah *et al.*, 2014; Napitupulu, 2016; Zahran *et al.*, 2015). In summary, from stage to stage, there is an increase in technological sophistication and an increase of the level of interaction provided to the users (Napitupulu, 2016), as well as an increase of the cultural and political level (Yusuf *et al.*, 2016). Nevertheless, there is no sequential transition among stages neither a well-defined separation among them (Zahran *et al.*, 2015). Despite the importance of knowing how mature national or municipal e-government is, maturity models do not answer to why e-government is not yet widely accepted by the citizens. They only provide an overview of e-government to the municipal or national level. Maturity models tend to provide the level of technology instead to focus on user needs (Wirtz and Kurtz, 2016).

That is why it was decided not to follow this approach. To evaluate in depth how e-government content is delivered to citizens, it was necessary to extend the research to areas imported from business, such as quality models, and to areas imported from Web design/development, such as Web accessibility, usability or UX, which seem closer to the users' needs, abilities or emotions (Janita and Miranda, 2018). Quality models have a strong influence from ISO standards (i.e.: ISO/IEC 25010; ISO/IEC 25012) and conformity principles (Fath-Allah *et al.*, 2014; Sá *et al.*, 2016). While maturity models of e-government focus mainly on technological stages, the quality models focus on domains (e.g.: service, information, system, organization, processes, technical, etc.) (Fath-Allah *et al.*, 2014; Hien, 2014; Papadomichelaki and Mentzas, 2012; Sá *et al.*, 2016). The bridge between research and policymakers is not, always, established. The European Union (EU) and its member states have promoted efforts to encourage citizens to use technologies to interact with the public administration (e.g.: through directives, legislation, action plans, and the provision of new sites and applications) (EC, 2016). Portugal is well placed in promoting these efforts. Its Electronic Government Development Index (EGDI) is currently at the highest level of four (very high; high; medium; low), according to the classification of the United Nations (UN, 2018: 91-96). However, the fast growth exposed some previous weaknesses. The increase in the number of websites in the PA resulted in the coexistence of new and modern sites with the old sites. The lack of coherence in terms of the interfaces of PA websites in Portugal shows the lack of strategies in the past (Fernandes, 2015). Therefore, legislation and initiatives, will not be effective, without realizing how users perceive the value of the information that is conveyed through the AP portals (Van Der Geest and Velleman, 2014). The focus on the attributes used to evaluate how the content of e-government is delivered to the users, is a step to help researchers and policymakers to understand how users can benefit, in the field, with the good results of the technological advances of Portugal in terms of e-government. The purpose of this systematic literature review was to identify the attributes used to evaluate e-government content, in order to understand how to improve the quality of government websites. To avoid conflicts in using more than one classification throughout this document, the term

in literature such as metrics, dimensions, characteristics, or categories, used to evaluate e-government content

MATERIALS AND METHODS

Exploratory research of Initiatives of EU and United States of America (USA) to make accessibility mandatory on government websites, and on the efforts of the web design industry in making websites more appealing, more useable, and responsive, drew the attention to the hypothetic contributions of web accessibility, usability, and user experience (UX) to the quality of the content delivered by government websites. These areas embrace a wide set of attributes and have never been explored together in the context of e-government research. Moreover, it raised the interest to the attributes used to evaluate e-government and guided the research question addressed in this study. A systematic literature review was performed to select studies were attributes to evaluate e-government content can be identified. The PRISMA statement has guided the research methodology (Moher *et al.*, 2009). Since the content of e-government websites includes a wide set of subjects, going from computer science issues to social issues, the following databases were adopted: Scopus; IEEE Xplore Digital Library; Science Citation Index; Social Sciences Citation Index. The databases chosen allowed to obtain publications which coverage provides a socio-technical perspective to this research. This study contributes to further researches in the future, by identifying and selecting a large set of attributes used to evaluate government websites.

RESEARCH METHODOLOGY

Figure 1 shows an overview of the research methodology, with an explanation of the steps followed and the justifications to the decisions adopted during this research.

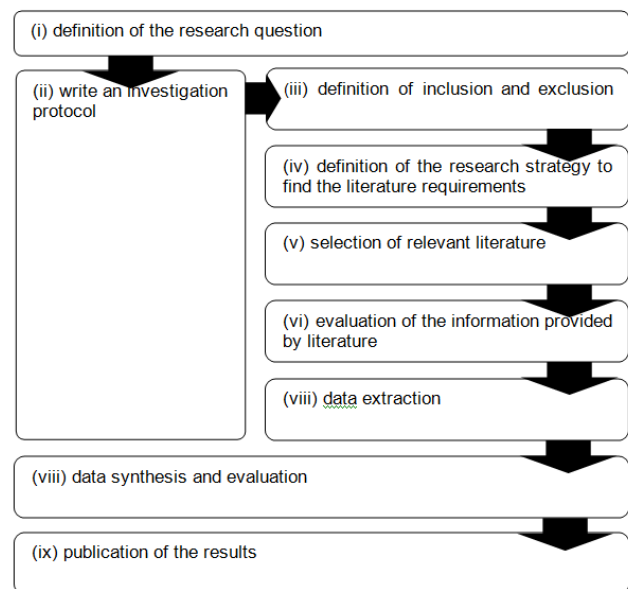


Figure 1. Overview of the research methodology

The research question addressed in this study is: what attributes are being used to evaluate e-government content

The research started with the investigation protocol, which defined the criterion to include or exclude documents, the research strategy to find the literature, what literature is relevant, how to evaluate the information provided by the literature, and what data to extract. The type of documents to include in the analysis were publications written in English or Portuguese, which subject included e-government research, published since 2000. The relevance to include documents published since 2000 is related to the growth of the interest on e-government in the second half of the nineties (Bannister and Grönlund, 2017; Scholl, 2012). Moreover, it provided an historical perspective of the evolution of the interest of e-government evaluation. The criteria to include publications written in Portuguese is justified by further developments of the study, which will focus on Portuguese e-government. The sources of information include books, book chapters, conference papers, and articles in peer-reviewed journals. The search strategy was limited to four databases: Scopus; IEEE Xplore Digital Library; Science Citation Index; Social Sciences Citation Index. The search started with an exploratory study in June 2017 and the last search occurred in May 2018. Since e-government is a multidisciplinary area, it was decided to include databases which publications cover also social and(or) technology fields (Dias, 2016). The strategy to query databases was designed to search documents by groups of subjects: (i) e-government maturity model – related with the level of the maturity of the technology offered by governments; (ii) e-government quality model – related with the evaluation of the quality of services, information, systems, organization, processes, interface web, content provided by e-government; (iii) e-government value model – related with the value added by e-government services; (iv) e-government usability – related with how e-government technology is useful to and usable by users; (v) e-government accessibility – related with how e-government technology is usable by people with special needs; (vi) e-government User Experience (UX) – related with the concern in providing a good user experience to users, with usable and engaged technology; (vii) e-government User Centered-Design (UCD) – related with the concern on the design of technology, that privileges user needs; (viii) e-government metrics – related with the (qualitative or quantitative) measures that can be adopted to evaluate e-government.

study. The decision to include these subjects was influenced by the perception that the content delivered by e-government may affect users' needs in the way they use and experience public administration websites. Moreover, these fields of study are relevant to web development and(or) web design, namely when involving e-government. The Initiatives of the European Union and the United States to make accessibility mandatory on government websites, are an evidence of such relevance. Another evidence is provided by the market. The efforts of the web design industry in making websites more appealing, more useable, and more responsive, cannot be ignored when considering e-government quality.

Method of Retrieval and Selection of Documents

The method adopted to obtain the documents was adapted from PRISMA statement and follows four stages (Moher et al., 2009): (i) identification – consisted on the identification of records and duplicates; (ii) screening – consisted on a brief analysis, based on the title, to decide what documents to include and what documents to exclude; (iii) eligibility – consisted on the assessment of the abstracts and the results of the documents to decide what documents to include and what documents to exclude for the next stage; (iv) included – consisted on the set of the studies selected for analysis. The identification stage started by querying databases. A set of eight queries, one per subject, was performed to the four databases. Table 1 shows the subjects, how the terms were combined to execute queries, and the results obtained per database. Databases query setup was made using the B-ON tool. A total of 599 records were identified through database searching. Twenty-nine new documents, obtained from previous exploratory research were added, totalizing 628 records. From this initial set 194 duplicates were removed. At the screening stage the titles of 434 records were analyzed. When the title did not seem aligned with one or more of the defined categories of subjects, the abstract was consulted to decide whether to exclude or include the document. At this stage, 272 documents were excluded. At the eligibility stage the abstracts and results of 162 documents were assessed. This assessment resulted in 103 documents being excluded and 59 documents eligible for analysis.

Table 1. Subjects, query performed and results

Subject	Query	Results per Database			
		Scopus	IEEE Xplore Digital Library	Science Citation Index	Social Sciences Citation Index
e-government maturity model	[SU] e-government AND [SU] model AND [SU] maturity	52	13	6	18
e-government quality model	[SU] e-government AND [SU] model AND [SU] quality	31	13	18	40
e-government value model	[SU] e-government AND [SU] model AND [SU] value	11	1	6	16
e-government usability	[SU] e-government AND [SU] usability	96	29	8	26
e-government accessibility	[SU] e-government AND [SU] accessibility	83	15	13	34
e-government User Experience (UX)	[SU] e-government AND [SU] (UX OR User Experience)	20	8	1	6
e-government User Centered-Design (UCD)	[SU] e-government AND [SU] (UCD OR User-Centered Design)	5	3	0	2
e-government metrics	[SU] e-government AND [SU] metrics	16	1	3	5

In each query the term “e-government” was included, combined with one or more of the following terms or their abbreviations: “model”; “maturity”; “quality”; “value”; “metrics”; “usability”; “accessibility”; “user experience”; “user-centered-design”. The subjects and the related terms were identified in previous exploratory research to prepare the

At the included stage 59 documents were selected for analysis. The method used for the analysis of the documents is explained below at the Method of Analysis of Documents section. Figure 2 provides an overview of the flow of the systematic review.

Method of Analysis of Documents: The analysis of the documents consisted in the identification and selection of concepts, classified by the authors of the selected studies as metrics, dimensions, characteristics, or categories, to evaluate content delivered by e-government. The metrics, dimensions, characteristics, or categories were obtained from models, frameworks, guidelines, or heuristics, proposed by the studies analyzed. Two main issues were found: (i) different roles were used to identify groups of concepts (metric, dimension, characteristic, or a category) - the adoption of these terms is not consensual in literature, and different authors adopt the terms that best fit their ideas; (ii) differences in terminology used by authors in similar contexts - the concepts used by authors to include on their artifacts (models, frameworks, guidelines, or heuristics) to evaluate e-government differs on the terms chosen. Some authors prefer to use adjectives, while other authors prefer to adopt nouns to refer to a similar variable. Regarding the first issue, it was decided not to differentiate the roles of the concepts. As stated in the introduction, the term attributes was adopted to cover these classifications. At this stage it is not relevant if a concept corresponds to a metric, a dimension, a characteristic, or any other classification. The second issue, related to the terms used, in different studies, to evaluate the same context (e.g.: accessible / accessibility or usable / usability) brought about the dilemma of choosing which word(s) best fit the evaluation of a certain context. Since this is an exploratory study and the results will be subject to users validation, we decided to select all attributes found, regardless of them being nouns or adjectives or if they represent a similar idea. In further validation of the attributes, users will be able to judge which concept has more meaning or better represents what is evaluated.

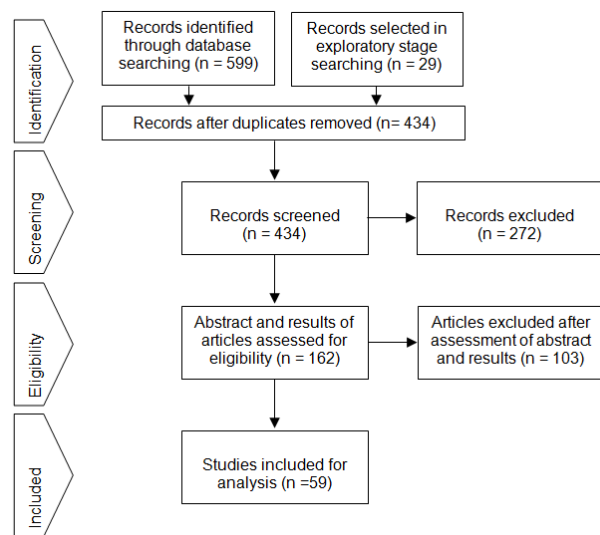


Figure 1. Stages of the systematic review

The process of gathering attributes was focused on the concepts rather than artifacts. This approach aims at obtaining a different perception of how the content of e-government websites is evaluated. Moreover, models, frameworks, guidelines, or heuristics, were not comparable, due to their different objectives. The selection of the attributes was based on their relevance on each artifact and the description, explanation, or vision, provided by the authors of the studies.

attributes, and an extensive interpretation was necessary. By extensive interpretation, we mean we had to seek information on external sources (dictionary, glossary, sources referenced by authors of the studies, etc.) that helped to clarify the meaning of the attribute. The attributes which were barely referred in the studies, which were not explained, or were not self-explanatory, were not selected. The attributes selected were annotated, in two complementary processes: (i) building a cognitive map, which helped in trying to establish relations between attributes - this map was frequently updated during the analysis process, and a cognitive map synthesis was made with the readings of the studies where attributes were mentioned and the interpretation of their relations on the artifacts; (ii) creating an alphabetically order list, to avoid duplicates. After completing the selection and the identification of the attributes, similarities were identified. The determination of the similarities between attributes was made by comparing terms, and by analyzing the context where attributes were adopted, and the explanation provided by the studies (when available). A description of each attribute was written, summarizing an interpretation of what each attribute evaluates.

RESULTS

From the review of the literature, 139 attributes were selected, from which 56 were identified as main attributes and 83 were identified as similar attributes. The distinction between main and similar attributes was not intended to establish a hierarchy; the main purpose was to group attributes whose meaning, idea, or application was close, minimizing redundancy. The attributes identified as similar are distributed by 43 of the main attributes. No similar attributes were found for the thirteen remaining attributes. The attributes identified in this study are presented below, in alphabetical order, and a brief explanation of those considered as main attributes is provided. Under each attribute a paragraph is included, with the attributes that are considered to be similar.

- **Accessibility:** in the web context, is identified as web accessibility. As far as e-government is concerned, its main purpose is to provide people with special needs the opportunity to interact with the government through the web (Kaisara and Pather, 2011; Sá et al., 2016; Verkijika and De Wet, 2018). It extends usability to the users which need a wide set of resources to interact with web interfaces (Bevan, 2008; Sohaib et al., 2011).
- **Similar attributes:** (i) accessible (Morville, 2005); (ii) access (Kaisara and Pather, 2011; Venkatesh et al., 2014); (iii) accessibility in use (Bevan, 2008; Lew et al., 2010).
- **Accuracy:** it relates to the level of informative content (Andrian et al., 2016), or services (Hendradjaya and Praptini, 2015). Privileges the absence of error on e-government portals (Karunasena and Deng, 2012). Similar attributes: (i) accurate (Lew et al., 2010); (ii) content accuracy (Lew et al., 2010); (iii) information accuracy (Hendradjaya and Praptini, 2015); (iv) service accuracy (Hendradjaya and Praptini, 2015).
- **Availability:** relates to the quality of e-government services (Sá et al., 2016). It evaluates how failures or interruptions affect one or more parts of government web systems (Alanezi et al., 2011; Papadomichelaki and Mentzas, 2009, 2012). Similar attributes: (i) available (Morville, 2005); (ii) service availability (Hendradjaya

availability (Alanezi et al., 2011; Hendradjaya and Praptini, 2015).

- **Citizen Engagement:** is related to the capability of e-government to offer content to motivate users' involvement in government processes (Karkin and Janssen, 2014).
- **Comfort:** relates to the physical satisfaction of the users when using government websites. Its impact may be perceived by sensorial perceptions (Bevan, 2008).
- **Compatibility:** is related to the capability of government websites to be accessed by standard hardware devices and by different browsers (Sá et al., 2016). The compatibility of hardware and software has an impact on accessibility, usability, and UX of government websites. Similar attributes: (i) hardware and software (Petrie and Bevan, 2009; Venkatesh et al., 2014); (ii) standard browser (Hendradjaya and Praptini, 2015).
- **Completeness:** it relates to the components necessary to provide autonomy to unexperimented users to access e-government content and obtain information (Kohlborn, 2014; Sivaji et al., 2014). Similar attributes: context completeness (Sivaji et al., 2014).
- **Compliance:** it relates to the conformity of government websites with the legal requirements and the standards (Iribarren et al., 2008; Andrian et al., 2016).
- **Confidentiality:** refers to the protection of the information provided by users through government websites to avoid abusive use (Iribarren et al., 2008; Andrian et al., 2016).
- **Content:** involves text, images, and media elements present on a web interface, as well as navigation elements (Sohaib et al., 2011). Elements of the content contribute to putting data in context and providing information to users of e-government (Karkin and Janssen, 2014; Venkatesh et al., 2014). Language terms adopted, clarity and the use of elements familiar to the users may be considered as relevant to improve content understanding (Fisher-Martins, 2011). Similar attributes: (i) content accuracy (Lew et al., 2010); (ii) content and appearance of information (Papadomichelaki and Mentzas, 2009, 2012); (iii) content organization (Petrie and Bevan, 2009; Venkatesh et al., 2014); (iv) content strategy (Garrett, 2011).
- **Context:** it relates to the circumstances that involve information, the user needs, expected user behavior, or tasks to use each e-government service or portal (Winckler et al., 2013). It helps to define which requirements content should meet to the target-users and limits the reach. Similar attributes: (i) context completeness (Petrie and Bevan, 2009; Sivaji et al., 2014); (ii) context conformity in use (Bevan, 2008); (iii) context extendibility in use (Bevan, 2008).
- **Correctness:** it relates to the evaluation of e-government content to avoid imprecision, ambiguity, or errors (Jansen and Ølnes, 2016).
- **Credibility:** it relates to the reputation of government website content. Content and(or) aesthetic elements should be organized to inspire credibility to the users (Nariman, 2011). In a wide sense, it relates to the usability (Huang and Benyoucef, 2014) and UX (Morville, 2005). Similar attributes: credible (Morville, 2005).
- **Ease of use:** it relates to how easy it is for users to interact with government websites to obtain or submit information (Nielsen, 2012). It is based on users' perceptions of how easy is to operate or control tasks when interacting with e-government (Lew et al., 2010; Papadomichelaki and Mentzas, 2009, 2012; Andrian et al., 2016; Sá et al., 2016; Lestari et al., 2017). Similar attributes: manageability (Andrian et al., 2016).
- **Effectiveness:** it relates to the success of the tasks performed by users when interacting with government websites (Bevan, 2008; Sivaji et al., 2014; Jansen and Ølnes, 2016; Lestari et al., 2017). It is fundamental to evaluate usability (Sivaji et al., 2014). Similar attributes: effectiveness in use (Bevan, 2008; Lew et al., 2010).
- **"Efficiency:** it relates to the performance obtained by users of government websites during task execution (Bevan, 2008; Alanezi et al., 2011; Nielsen, 2012; Sivaji et al., 2014; Lestari et al., 2017). It is considered fundamental to evaluate usability (Sivaji et al., 2014) and accessibility (Janita and Miranda, 2018). Similar attributes: (i) access time (Hendradjaya and Praptini, 2015); (ii) efficiency in use (Bevan, 2008; Lew et al., 2010); (iii) process ..."
- **Emotion:** it relates to users' perceptions of the experiences felt when interacting with government websites. It is considered a key element of UX evaluation (Winckler et al., 2013). Similar attributes: emotional appeal (Sá et al., 2016).
- **Errors:** it relates to the actions of the user while interacting with government websites. The website should be designed to minimize user operation errors and to protect him/her from undesirable consequences (Lew et al., 2010; Nielsen, 2012; Sivaji et al., 2014). Similar attributes: (i) error tolerance (Lew et al., 2010); (ii) user error protection (Sivaji et al., 2014).
- **Findability:** it relates to how government websites are findable and how users find the content that meets their needs (Rosenfeld et al., 2015). Similar attributes: findable (Morville, 2005).
- **Flexibility in use:** it relates to the use of government websites in all possible contexts (capability to adapt to emerging needs), including accessibility (Bevan, 2008). The attributes context conformity, context extensibility, and accessibility are related to this attribute (Bevan, 2008).
- **Functionality:** it relates to the technological aspects of government websites interface (Sohaib et al., 2011). Most of these aspects help the users in their interaction and results in quality improvements when interacting with the content (Sá et al., 2016). Similar attributes: functionality of the interaction environment (Papadomichelaki and Mentzas, 2009, 2012; Sá et al., 2016).
- **Hedonic Quality:** it relates to the capability of government websites to influence users to feel competent in performing their actions (Hassenzahl, 2007, 2010). It is considered a key element to improve UX. Its evaluation is based on three facets: (i) stimulation, related with the impact of the change or the novelty (Hassenzahl, 2007; Peedu and Lamas, 2011; Winckler et al., 2013); (ii) identification, related with users identity and the way it is expressed in the website characteristics (Hassenzahl, 2007; Peedu and Lamas,

- 2011; Winckler et al., 2013); (iii) evocation, related with users memories and how they influence their actions while interacting with the website (Hassenzahl, 2007). Similar attributes: pleasure (Bevan, 2008).
- **Helpfulness:** it relates to how government websites help users with their operation needs, and how the help is effective, namely for unexperimented users (Lew et al., 2010).
 - **Information:** this is a key attribute to government websites. It may be considered the main reason that leads uses to interact with e-government (Kaisara and Pather, 2011). Information should have a set of qualities such as robust, precise, complete, useful, updated, understandable and relevant (Alanezi et al., 2011; Fisher-Martins, 2011; Hendradjaya and Praptini, 2015; Andrian et al., 2016; Sá et al., 2016; Janita and Miranda, 2018). Information quality is seen as a key element to the trust of the users on e-government (Hendradjaya and Praptini, 2015). Similar attributes: (i) complete information (Andrian et al., 2016); (ii) content and appearance of information (Papadomichelaki and Mentzas, 2009, 2012); (iii) information architecture (Faisal et al., 2016; Garrett, 2011); (iii) information design (Garrett, 2011); (iv) information integrity (Andrian et al., 2016); (v) information quality (Alanezi et al., 2011; Fath-Allah et al., 2014; Hendradjaya and Praptini, 2015; Sá et al., 2016; Janita and Miranda, 2018).
 - **Interactivity:** it relates to the elements that government websites should meet, allowing users to complete the tasks that satisfy their needs (Alanezi et al., 2011). It implies an “active” role of the website to help users to obtain information (Papadomichelaki and Mentzas, 2012; Sá et al., 2016; Yuan et al., 2012). Similar attributes: (i) citizen support (Papadomichelaki and Mentzas, 2009, 2012); (ii) functionality of the interaction environment (Papadomichelaki and Mentzas, 2009, 2012; Sá et al., 2016); (iii) interaction design (Garrett, 2011; Faisal et al., 2016).
 - **Interface:** it is a key element of government websites. Represents the main door for users to interact with PA using digital technologies. The challenge of the interface attribute consists of the organization of its components to anticipate users’ needs (Rosenfeld et al., 2015). The attributes interactivity, customization, and usability have an impact on the evaluation of interface design (Garrett, 2011; Alanezi et al., 2011; Kaisara and Pather, 2011; Youngblood and Youngblood, 2018). Similar attributes: (i) interface design (Garrett, 2011); (ii) screen (Venkatesh et al., 2014). (iii) user interface usability (Bevan, 2008).
 - **Interoperability:** consists of the integration of different e-government services in one portal or website and providing a transparent view to the users (Sá et al., 2016). Also, it helps to simplify the relations between government and public employees, businesses, or users: (i) G2E; (ii) G2B; (iii) G2C (Andrian et al., 2016; Zautashvili, 2017).
 - **Language:** its relation with the content of government websites can be framed by different views: (i) the pattern of language adopted to write content (e.g.: colloquial, formal, simple, etc.) can be used to segment the target users according to their educational level or qualifications (Kaisara and Pather, 2011); (ii) the information written on native country language may be complemented with other idioms to allow foreign users (tourists, business investors, etc.) to interact with government services (Hendradjaya and Praptini, 2015). Similar attributes: **multi-lingual** (Hendradjaya and Praptini, 2015).
 - **Learnability:** it relates to the level of support needed by users who interact with the government websites for the first time, to be effective and efficient in task execution (Nielsen, 2012; Sivaji et al., 2014). Similar attributes: **learnability in use** (Bevan, 2008; Lew et al., 2010).
 - **Legitimacy:** it relates to how users perceive a government website. If the website looks official and legitim or not. Some website elements such as government logotype, authentication mechanisms, contacts, or disclaimers are pieces of evidence (Verkijika and De Wet, 2018).
 - **Meaning and Value:** users’ choices, in a wide sense, represent what they value the most (Winckler et al., 2013). Government websites should allow users to obtain value with their interaction with e-government. Availability 24 hours a day, 365 days per year, means value to users who have no time to contact services in person (Morville, 2005; Winckler et al., 2013). Similar attributes: **valuable** (Morville, 2005).
 - **Memorability:** it relates to how government website interface influences users to remember the steps to execute a task after a period without visiting the website. In a wide sense, it relates to how the website stimulates user proficiency (Nielsen, 2012).
 - **Navigation:** it relates to the navigability of government websites to make it easier for users to access content. Navigation may be segmented according to different levels (e.g.: global, local, contextual) or performed through a website search engine (Venkatesh et al., 2014). Navigation elements should have no broken links (Kaisara and Pather, 2011; Verkijika and De Wet, 2018). Similar attributes: (i) **navigation design** (Garrett, 2011); (ii) **search** (Kaisara and Pather, 2011; Venkatesh et al., 2014).
 - **Operability:** it relates to the input devices, the time needed by users to operate government website interfaces, and the navigability of the website (Anderson et al., 2004; Sivaji et al., 2014). It is a key attribute of accessibility. Similar attributes: **operable** (Sivaji et al., 2014; Andrian et al., 2016; Acosta-Vargas et al., 2017).
 - **Perceivability:** it relates to how users perceive the content of government websites using tact, vision, or hearing. It focusses on the alternatives to improve user perceivability (Acosta-Vargas et al., 2017; Al-Mourad et al., 2019). Also, it is a key attribute of accessibility. Similar attributes: **perceivable** (Acosta-Vargas et al., 2017).
 - **Personalization:** it relates to the setup of some users’ preferences to make more pleasurable their use of e-government (e.g.: interface colors; font size; language; etc.). The satisfaction of users’ preferences may increase their perception of website quality (Alanezi et al., 2011; Papadomichelaki and Mentzas, 2009, 2012; Youngblood and Youngblood, 2018). Similar attributes: **customization** (Papadomichelaki and Mentzas, 2012; Sá et al., 2016).

- **Pragmatic Quality:** it relates to the perceptions of users about the capability of a government website to satisfy their needs (Hassenzahl, 2007, 2010). Similar attributes: **likability** (Bevan, 2008).
- **Privacy:** it relates to the policies of government websites to protect user data (Alanezi et al., 2011; Sá et al., 2016). Also, this attribute is usually related to the security of user data (Verkijika and De Wet, 2018). It is a key attribute to evaluate users' trust in e-government (Karkin and Janssen, 2014).
- **Quality:** this a key attribute to evaluate e-government. It relates to the purposes of the governments in offering valuable digital services to the community (Janita and Miranda, 2018). Government website quality may be a result of the combination of a wide set of attributes like usability, accessibility, availability, content, trust, consistency, updates, or response-time (Markaki et al., 2010; Karkin and Janssen, 2014). Similar attributes: (i) information quality (Alanezi et al., 2011; Fath-Allah et al., 2014; Hendradjaya and Praptini, 2015; Sá et al., 2016; Janita and Miranda, 2018); (ii) product quality (Sivaji et al., 2014); (iii) quality in use (Bevan, 2008; Lew et al., 2010; Sivaji et al., 2014); (iv) service quality (Alawneh et al., 2013); (v) system quality (Weerakkody et al., 2016); (vi) website quality (Fath-Allah et al., 2014).
- **Reliability:** it relates to the number of failures that occurred on a government website, in a certain period of time. It allows to evaluate the capability to match its mission with availability expectations (Papadomichelaki and Mentzas, 2012; Sá et al., 2016; Janita and Miranda, 2018).
- **Responsiveness:** it relates to the capability of government websites in providing answers to the contacts made by users (Venkatesh et al., 2014). The answer should be useful to the user and provided in a reasonable time (Karkin and Janssen, 2014; Hendradjaya, and Praptini, 2015). Similar attributes: (i) communication (Janita and Miranda, 2018); (ii) contact (Alanezi et al., 2011; Sá et al., 2016); (iii) customer support (Sá et al., 2016) (iv) dialog (Karkin and Janssen, 2014); (v) fulfillment (Alanezi et al., 2011).
- **Responsivity:** it relates to the ubiquity of the devices and the size of their display. In terms of government websites, they seek to provide interfaces that dynamically adjust content to the display size, maintaining the fundamental options and elements (Youngblood and Youngblood, 2018). Similar attributes: responsive design (Almeida and Monteiro, 2017; Youngblood and Youngblood, 2018).
- **Robustness:** it relates to the content of government websites and how it can be parsed correctly by a set of user agents, which includes assistive technologies (Al-Mourad et al., 2019). It is a key attribute of accessibility. Similar attributes: robust (Anderson et al., 2004; Acosta-Vargas et al., 2017; Al-Khalifa et al., 2016).
- **Safety:** it relates to the prevention of undesirable consequences that a government website may have to the users (Bevan, 2008). It focusses on reducing the risks related to the utilization context without preventing users from performing their tasks with satisfaction (Lew et al., 2010). Similar attributes: freedom from risk (Sivaji et al., 2014).
- **Satisfaction:** it is related to how government websites lead users to reach pragmatic and hedonic objectives (Hassenzahl, 2007; Bevan, 2008; Sivaji et al., 2014). This attribute is influenced by other website attributes like utility, ease of use, aesthetics (Alanezi et al., 2011; Nielsen, 2012; Sivaji et al., 2014; Lestari et al., 2017) or the user expectations (Bevan, 2008). Similar attributes: (i) satisfaction in use (Bevan, 2008; Lew et al., 2010); (ii) user satisfaction (De Róiste, 2013; Nariman, 2011, 2012; Hendradjaya and Praptini, 2015).
- **Security:** it relates to the techniques adopted to protect data. In government websites, content and user data need to be protected to ensure privacy and(or) confidentiality (Alawneh et al., 2013; Janita and Miranda, 2018). Similar attributes: security and trust (Hendradjaya and Praptini, 2015).
- **Service:** it relates to the value of the content, information, and tasks to the user when interacting with public administration, using e-government (Verkijika and De Wet, 2018). The perceptions of value derive from the functionalities of the service (e.g.: level of information; forms; notifications; alerts; media; etc.) (Alawneh et al., 2013; Fath-Allah et al., 2014). Similar attributes: (i) service accuracy (Hendradjaya and Praptini, 2015); (ii) service availability (Hendradjaya and Praptini, 2015; Sá et al., 2016); (iii) service quality (Alawneh et al., 2013).
- **Transparency:** it relates to content about government activities disclosed through e-government (e.g.: legal information; public contacts; infrastructure costs; government activities; etc.) (Yuan et al., 2012). A high level of transparency will influence users to trust the government (Youngblood and Youngblood, 2018). Similar attributes: transparency of actions (Sá et al., 2016).
- **Trust:** it relates to the satisfaction of users' expectations when interacting with government websites. It is influenced by how users perceive attributes like security, privacy, or availability of content (Bevan, 2008; Alanezi et al., 2011; Sá et al., 2016). Usability (Bevan, 2008), UX (Alawneh et al., 2013; Youngblood and Youngblood, 2018), and quality (Sá et al., 2016) are key attributes to the trust of users on government websites. Similar attributes: security and trust (Hendradjaya and Praptini, 2015).
- **Understandability:** it relates to content format (navigation or informative) of government websites to make it understandable to the users. It should be predictable, operable, and readable to avoid erroneous actions or misunderstandings of users (Anderson et al., 2004; Acosta-Vargas et al., 2017; Al-Khalifa et al., 2016; Al-Mourad et al., 2019). It is a key attribute to accessibility. Similar attributes: (i) comprehensibility (Sohaib et al., 2011); (ii) understandable (Anderson et al., 2004; Acosta-Vargas et al., 2017).
- **Update:** it relates to the need to maintain updated government websites content to meet users' needs (Nariman, 2011; Karkin and Janssen, 2014). Similar attributes: up to date (Hendradjaya and Praptini, 2015).

- **Usability:** it relates to how easy it is for users to interact with government websites interface to satisfy their needs with good performance (Bevan, 2008). Users should be able to understand the interface and its use context (Lestari et al., 2017). The objective of this attribute is, mainly, pragmatic. It focusses on the conclusion of tasks. (Karkin and Janssen, 2014; Bevan et al., 2015). It is a key attribute of the quality of government websites. Similar attributes: (i) usability in use (Bevan, 2008); (ii) actual usability (Lew et al., 2010); (iii) usable (Morville, 2005; Sá et al., 2016); (iv) user interface usability (Bevan, 2008).
- **Usefulness:** it results from the combination between the usability of a government website and how useful it can be to the users (Nielsen, 2012). Similar attributes: (i) perceived usefulness (Sabah et al., 2015); (ii) useful (Morville, 2005).
- **User Experience (UX):** it relates to the preferences of users, their perceptions, emotions, psychological and physical responses while using government websites (Lew et al., 2010; De Róiste, 2013; Bevan et al., 2015). Usability and accessibility are key attributes to improve UX (Lestari et al., 2017), and extending the pragmatic (efficiency and effectiveness) to the experiential level (adorable) (Ketola and Roto, 2008). Similar attributes: (i) actual user experience (Bevan, 2008; Lew et al., 2010); (ii) citizens experience (Sivaji et al., 2014); (iii) end-users experience (Følstad et al., 2008) (iv) visual and aesthetic experience (Winckler et al., 2013).
- **Utility:** it relates to the alignment between the government websites purposes and the users' needs. Government websites should provide the necessary functionalities to meet users' objectives (Nielsen, 2012; Bevan, 2008; Faisal et al., 2016).
- **Visual Elements:** it relates to the elements of the government websites that can be observed by users. It may impact usability perception (Winckler et al., 2013; Karkin and Janssen, 2014), as well as UX of the website (Bevan, 2008; Garrett, 2011; Kaisara and Pather, 2011). It is directly connected with the aesthetics of the website. Similar attributes: (i) attractiveness (Peedu and Lamas, 2011); (ii) branding (Sohaib et al., 2011); (iii) design (Sá et al., 2016); (iv) desirable (Morville, 2005); (v) format (Alanezi et al., 2011); (vi) website layout (Karkin and Janssen, 2014); (vii) visual and aesthetic experience (Winckler et al., 2013); (viii) visual design (Faisal et al., 2016; Sohaib et al., 2011).

DISCUSSION

The approach followed to select the attributes had three main concerns: (i) to identify attributes used to evaluate how government content is delivered to the users; (ii) to obtain an understanding of the meaning of each attribute; (iii) to have an overview of the most adopted attributes in order to, in the future, validate their relevance to the users/citizens. The first two concerns were summarized in the results section. The third concern is discussed above, explaining the reasoning to identify the most important attributes and how they relate to each other. Next, explanation is provided on why it is relevant not to underestimate the attributes that are outside of the main scope of the study. Finally, a brief explanation on how the terminology of the attributes was analyzed and how this contributed to minimizing their redundancy is provided. The

large number of attributes identified, suggests the use of visual aids to help identifying possible relations between them. As referred in the section Method of Analysis of Documents, a cognitive map was adopted to provide an overview of how attributes may relate to each other. Attributes such as quality, interface, content, information, user experience, usability, and accessibility were highlighted. Quality appears on literature as a multidimensional concept. There is no consensus about the extent of the attributes to be present in its evaluation (Papadomichelaki and Mentzas, 2009, 2012). The studies analyzed, classify quality under different conceptualizations. It ranges from a wide perspective (e.g.: e-government; websites) to a restricted perspective (e.g.: content; information; service). This explains why the attributes UX, usability, accessibility, interface, content, or information are not contained in every conceptualization of quality. An extensive interpretation of the different contexts and the roles of these attributes was necessary to understand how they relate with each other in the context of the evaluation of e-government content provided to the users. The attention centered on attribute quality is justified by its role in the path to bringing excellence to government website content. Website interface is the main door for users to interact with content and obtain information (Kaisara and Pather, 2011). Web interface design and development can be understood as an anticipation of the users' needs by adopting techniques suggested in the studies concerning UX, Usability, and Accessibility. Interface, Content, and Information can be considered high-level attributes, due to their visibility to the users.

Interface comprehends a set of technical components to organize navigation content and information content to put data on context and provide information to users. However, its level of organization or the value perceived by users when interacting with the interface, may depend on how knowledge related to UX, usability, and accessibility attributes was adopted during the design. These three attributes are described, sometimes, as close and related in terms of web development. When mentioning that UX is targeted towards the development of web responsive products to be used effectively and efficiently by users, and also that accessibility plays a similar role in approximating the users, Sohaib et al. (2011) are establishing a complementarity between these attributes. The role of Usability focuses on the conclusion of tasks in an effective and efficient manner to provide user satisfaction (Bevan, 2008). Usability is not oriented to a specific type of public. However, Accessibility is. It extends Usability to people with special needs, by suggesting techniques to make web content more inclusive and providing guidelines to evaluate how accessible web interfaces are. UX is related to the aesthetics and the design of the interface (Bevan, 2008; Garrett, 2011). It extends the pragmatic objective of usability to hedonic objectives, by stimulating user emotions (Petrie and Bevan, 2009; Hassenzahl, 2008). UX focus is to provide pleasure when the user interacts with the website (Bevan et al., 2015). The importance of these attributes is apparent in the existing studies, where they are associated to the development of web interfaces, namely due to their strong influence on how content is presented to the users. Also, the attributes that appear in the context of the first ones (e.g.: efficiency, effectiveness, and satisfaction appearing to be subordinated to usability) cannot be underestimated. They should be analyzed under two complementary perspectives: (i) their contribution in helping to understand the meaning of the main attributes (e.g.: task-oriented; aesthetics oriented; etc.); and (ii) as an

indirect method to perceive what attributes could be most valuable to the users (e.g.: if a user values attributes of usability it is possible to infer that the user, indirectly, values usability). Attributes can also be regarded as domains (e.g.: the system; a service; the content; information; data). This means the domain may define the boundaries to select what attributes are eligible for its evaluation. The risk is to ignore other influential attributes. Content of e-government does not exist separated from services, systems, data, or users. An evidence of this are the cases of the attributes satisfaction or users trust, which are influenced by visual attributes or accessibility, usability, efficiency, security, and privacy, among others (Alanezi *et al.*, 2011; Bevan, 2008; Sá *et al.*, 2016; Venkatesh *et al.*, 2014; Youngblood and Youngblood, 2018).

A relevant issue is how each attribute assessment can be operationalized. As the results section makes clear, different attributes may require different approaches for their assessment. Qualitative techniques seem to be the most appropriate to assess the attributes related to user perceptions (e.g.: visual elements; utility; safety; trust; etc.). However, to quantify attributes related to behavior (e.g.: efficiency; effectiveness; etc.) quantitative techniques are recommended. In synthesis, for attributes whose evaluation depends on the results of the evaluation of other attributes (e.g.: the attributes efficiency, effectiveness, and satisfaction, influence usability), their evaluation may become hybrid. Depending on the type of attributes, quantitative and qualitative techniques may be adopted. After establishing the clues on which attributes are more relevant for evaluating the content of government websites, and justifying why the attributes selection should not be based only on the main scope of the study, attention was focused on identifying the terminological differences between the attributes. Some of the examples are: (i) the suffix "...in use" is used to differentiate tests made with real users from laboratory tests (e.g.: accessibility in use; quality in use; usability in use; etc.) (Bevan, 2008); (ii) the indiscriminate adoption of an adjective or a noun to represent the same attribute idea was detected in different studies (e.g.: accessible vs accessibility; responsive vs responsiveness; robust vs robustness); (iii) contextualized use of slightly different terms was also found in different studies (e.g.: language vs multi-lingual; responsivity vs responsive design). The analysis of the terminological differences contributed to group attributes that represent the same idea or similar ideas. This approach helped to minimize the redundancy, as can be observed in the results section.

Conclusion

The scope of this study was to identify what attributes are being used to evaluate e-government content provided to the users by e-government websites. The research resulted in the identification of 139 attributes, from which 56 were identified as main attributes, and 83 were identified as similar attributes. A brief description of the 56 attributes was provided, together with some similar attributes. Attributes such as quality, interface, content, information, user experience, usability, and accessibility emerged as the most relevant attributes, and they relate to one another in the evaluation of how e-government content is provided. The study has the following limitations: (i) terms used to query databases were suggested from a previous exploratory search to prepare the study. It is possible that if other terms or combinations are used to query the databases, other studies may be retrieved, which may lead to different

results; (ii) the databases used were limited to those available in the B-On platform with access to full-text documents. Despite their relevance, other options could be explored; (iii) part of the attributes found have a lack of explanation about their role, and it was necessary to perform an extensive interpretation. Since the interpretation was based on author past experiences and convictions, there may be a bias in the understanding of the less clear attributes with consequences on their description on this document and the interpretation of similarities among attributes; (iv) terminology adopted in studies reviewed was very diversified. The decision in choosing a term rather than others may be questioned; (v) the study was focused on identifying attributes and not in analyzing in depth how they can be evaluated, therefore, the relevance of some of the attributes may be questioned; (vi) despite the effort to identify the largest number of attributes, the possibility of new attributes being added or suggested remains open. As future work, a sample of the attributes selected in this study will be submitted for validation to a sample of common users/citizens, using a focus group technique. The result will be a set of attributes to integrate a model for the evaluation of e-government websites, aiming at improving the value of the content delivered to users. Additionally, a deep analysis of the techniques to evaluate the attributes selected is suggested.

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