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Adoption of e-government: a study on the role of trust

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This study analyzed the influence of trust and trustworthiness on the intention to adopt and use e-government services. A structural model was proposed, considering the relationship among Ability, Benevolence, Integrity, Perceived Risk, Trust of the Government, Trust of the Internet and Disposition to Trust. The model was tested through structural equation modeling (partial least square method). An online questionnaire was applied, including 36 items for all the constructs presented in the model, and measured with 11-point Likert scales. After the first round of analysis, an alternative model was proposed with a better fit. Results indicated that: 1) Ability, Benevolence, and Integrity, together, positively influence Trust of the Government; 2) Trust of the Government and Trust of the Internet positively influence Trust in e-Government; 3) Trust in e-Government negatively influences Perceived Risk and positively influences Intention to Use and; 5) Perceived Risk negatively influences Intention to Use. Considering the results of this research, as government agencies increase their expenditure to implement and maintain e-gov initiatives, they must recognize and deal with trust-related issues.

Keywords: trust; adoption; electronic government.

Adoção do governo eletrônico: um estudo sobre o papel da confiança

O presente trabalho teve como objetivo analisar a influência da confiança e da confiabilidade na intenção de adoção e uso de serviços eletrônicos do governo (e-gov). Para isso, foi proposto um modelo estrutural, considerando o relacionamento dos constructos Capacidade, Benevolência, Integridade, Experiência, Risco Percebido, Confiança no Governo e Disposição para Confiar. O modelo foi testado por meio de modelagem de equações estruturais (mínimos quadrados parciais). A coleta de dados ocorreu por intermédio de questionário na internet composto por 36 itens com escalas do tipo Likert de 11 pontos para os constructos presentes no modelo. Depois da primeira rodada de análise, foi proposto um modelo alternativo com melhor ajuste. Neste, observou-se que: 1) Capacidade, Benevolência e Integridade juntos influenciam positivamente a Confiança no Governo; 2) Confiança no Governo e Confiança na Internet influenciam positivamente a Confiança no e-gov; 3) Confiança no e-gov influencia negativamente o Risco Percebido e positivamente a Intenção de Uso de e-gov; e 5) Risco Percebido influencia negativamente a Intenção de Uso de e-gov. Considerando os resultados da pesquisa, conforme as agências governamentais aumentam os gastos para implementar e manter iniciativas de e-gov, é imprescindível que também reconheçam e tratem de questões associadas à confiança.

Palavras-chave: confiança; adoção; governo eletrônico.

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Adopción del gobierno electrónico: un estudio sobre el papel de la confianza

El presente estudio tuvo como objetivo analizar la influencia de la confianza y la fiabilidad en la intención de adoptar y utilizar los servicios de gobierno electrónico (e-gov). Para ello, se propuso un modelo estructural, considerando la relación de los constructos capacidad, benevolencia, integridad, experiencia, riesgo percibido, confianza en el Gobierno y disposición a confiar. El modelo se probó utilizando el modelado de ecuaciones estructurales (mínimos cuadrados parciales). La recolección de datos se realizó a través de un cuestionario de Internet que consta de 36 ítems con escalas Likert de 11 puntos para los constructos presentes en el modelo. Después de la primera ronda de análisis, se propuso un modelo alternativo con un mejor ajuste. En este último, se observó que: 1) capacidad, benevolencia e integridad, en conjunto, influyen positivamente en la confianza en el Gobierno; 2) La confianza en el Gobierno y la confianza en Internet influyen positivamente en la confianza en el e-gov; 3) La confianza en el gobierno electrónico influye negativamente en el riesgo percibido y positivamente en la intención de usar el gobierno electrónico y; 5) El riesgo percibido influye negativamente en la intención de usar el e-gov. Dados los resultados de la encuesta, a medida que las agencias gubernamentales aumentan el gasto para implementar y mantener iniciativas de gobierno electrónico, es imperativo que también reconozcan y aborden los problemas asociados con la confianza.

Palabras clave: confianza; adopción; gobierno electrónico.

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1. INTRODUCTION

Information and communication technologies (ICTs) provide faster and more efficient ways to solve everyday problems and actions. In today's society, where the needs and demands of citizens are not only increasing, but continuously changing, the government must also respond quickly to such changes. In this context, the so-called electronic government (e-gov) is situated, which consists of the use of ICTs combined with organizational changes to improve government structures and operations (Twizeyimana & Andersson, 2019), as well as improve the quality, availability, accessibility, efficiency, and effectiveness, and reduce the time and cost of services provided (Al-Zahrani, 2020; Gil-Garcia & Flores-Zúñiga, 2020; Shareef, Archer, V. Kumar, & U. Kumar, 2010).

Due to the crisis stemming from the COVID-19 pandemic, it was necessary for governments not only to expand the services provided via the Internet, but also to optimize their ability to provide information and communicate with the population. There was a sense of urgency, but it also had to consider the acceptance, by individuals, of what is being provided by the public administration. From a practical standpoint, there has been a proportional increase in the relationship between government and citizens via the Internet. In Brazil, for example, data from the Regional Center for Studies on the Development of The Information Society (Cetic.br) indicate that in 2019, 68% of people made use of some kind of e-gov initiative (Comitê Gestor da Internet no Brasil [CGI], 2020a). In the context of the

pandemic, due to the need imposed by the quarantine period, social isolation and limited in-person services in public organizations, this number increased to 92%, in the first months of 2020 (CGI, 2020b).

Previous research in the context of e-gov has attempted to identify what factors have influenced service adoption. Among them, citizen trust has been indicated as an essential element for the adoption of e-gov services (Munyoka & Maharaj, 2019; Warkentin, Gefen, Pavlou, & Rose, 2002; Warkentin, Sharma, Gefen, Rose, & Pavlou, 2018). After all, unlike traditional means of interacting with government, services offered through electronic means have an impersonal and distant nature, a consequence of the Internet (Bélanger & Carter, 2008). Therefore, citizens need to have trust in both the government and the technology that allows e-gov services to be used as a means of functioning (Carter & Bélanger, 2005).

However, to understand the phenomenon of trust in e-government (henceforth also defined as trust in e-gov) and its outcome on usage intention, more complex relationships need to be considered. Factors such as trustworthiness (Kurfali, Arifoglu, Tokdemir, & Pacin, 2017; Verkijika & De Wet, 2018; Warkentin et al., 2018), perceived risk (Dwivedi et al., 2017; Munyoka & Maharaj, 2019; Verkijika & De Wet, 2018), ability (Beldad, Jong, & Steehouder, 2011; Gao & Waechter, 2015; Janssen, Rana, Slade, & Dwivedi, 2018), integrity (Gao & Waechter, 2015; Tan, Benbasat, & Cenfetelli, 2008), benevolence (Gao & Waechter, 2015; Tan et al., 2008), and experience (Warkentin et al., 2002) present themselves as potential predictors of trust in e-gov, but are still unexplored as a whole.

In this work, therefore, we intend to propose a theoretical model considering such dimensions, in order to establish the relationship between them. Thus, we hope to contribute to: 1) the disambiguation between the terms trust and trustworthiness; 2) the role these factors play in the adoption of e-gov services; and, finally, 3) the development and testing of an e-gov model of its own. Investigating these issues is important so that policy makers and bureaucrats can plan specific mechanisms and strategies to increase the use of e-gov (Samuel, Doctor, Christian, & Baradi, 2020). As interest in this type of service grows, it becomes necessary to investigate the motivating factors and barriers to the adoption of what is being provided to individuals (Warkentin et al., 2002; Warkentin et al., 2018; Samuel et al., 2020).

In order to accomplish the intended purpose, the study is structured as follows: first, a literature review on the approached dimensions is presented; then, the research method, characterized by the application of a questionnaire that includes scales for each of the dimensions of the research model, is described; soon after, the results are shown together with their respective analysis; finally, the conclusions, the limitations and future research are established.

2. THEORETICAL BACKGROUND

2.1. Trust, trustworthiness and perceived risk

Trust can be defined as the willingness of a party to become vulnerable, defenseless, or exposed as a result of the actions of another party when considering an expectation that this other party will perform an action that is particularly important to the individual who trusts (trustor), regardless of the ability to monitor and control the actions of the trusted individual (trustee) (Mayer, Davis, & Schoorman, 1995). In other words, it refers to the act of an individual becoming vulnerable to another individual, group, or institution that has the ability to harm or betray him (Levi & Stoker, 2000). It is a relationship that is based on the trusting individual's (trustor) assessment of the trusted

individual's (trustee) intentions regarding some action (Hardin, 2002). Warkentin et al. (2002) work with the centrality of trust to interactions and define it as a crucial factor in any of these interactions, whether they are economic (such as those carried out in commerce) or social (such as the interactions that occur in everyday life with different agents). Bringing it into the context of this research, one can frame Trust in e-gov as the degree to which the services offered by the government, via the Internet, are trustworthy. This can be applicable both generally to e-gov and to a specific service, such as income tax returns (Warkentin et al., 2002). Therefore, it is plausible to consider that the more one trusts what is offered electronically in terms of public services, the greater is the intention to use it.

Hypothesis 1: *trust in e-gov* positively influences the *intention to use*.

Trust can be produced by the characteristics of the actors involved, the institutional apparatus, and processes (Zucker, 1986). The first mode of trust production is linked to the characteristics of the individual who trusts (trustor) and also the individual who is trusted (trustee). The characteristics of the trusting individual (trustor) are analyzed here as Disposition to Trust and represent a general propensity to trust other people (Zucker, 1986). Such a concept has been widely employed both in the context of e-commerce services and in the context of e-gov services. Here, disposition to trust can be understood as an individual's general propensity to trust other people that influences their beliefs and intentions toward a government agent with whom a transaction is being made electronically (Alsaghier, Ford, Nguyen, & Hexel, 2009; Belanger & Carter, 2008; Luo, Li, Zhang, & Shim, 2010; Mcknight, Choudhury, & Kacmar, 2002; Warkentin et al., 2002).

The characteristics of the trusted individual (trustee), on the other hand, are analyzed here as trustworthiness, which represents the perception of the characteristics of a trusted individual (Zucker, 1986). The concepts of trust and trustworthiness are not synonymous. Trust behaves as a product generated based on the influence of trustworthiness and also on other factors that go beyond the characteristics of the individual being trusted (trustee). Thus, trustworthiness is an important factor in the generation of trust. *Trustworthiness* refers to the properties by which a trusted entity - be it another person or an institution - serves the interests of the entity being trusted, be it a person or an institution (Avgerou, Ganzaroli, Poulymenakou, & Reinhard, 2009; Janssen et al., 2018; Levi & Stoker, 2000).

Given the subject matter of this article, it can be operationalized through the concept of Trust of Government, which refers to an individual's perception of the integrity and ability of a government agency to provide a given service (Bélanger & Carter, 2008). Trust is widely used both in the context of e-commerce services and in the context of e-gov services (Alzahrani, Al-Karaghouli, & Weerakkody, 2017; Mota, Bellini, Souza, & Oliveira, 2016; Verkijika & De Wet, 2018; Warkentin et al., 2018).

The second mode of trust generation is institutional (Zucker, 1986). It is related to the institutional structures through which the action is being performed by the actors and can be operationalized as Trust of the Internet, which represents the institutional view of trust (Bélanger & Carter, 2008), which has been widely employed in both e-commerce and e-gov services contexts (e.g., Kurfali et al., 2017;

Mota et al., 2016; Verkijika & De Wet, 2018). Based on what has been presented so far, it is possible to establish the following hypotheses of the study, listed as follows:

Hypothesis 2: *disposition to trust* positively influences *trust of government*.
Hypothesis 3: *disposition to trust* positively influences *trust of the Internet*.
Hypothesis 4: *disposition to trust* positively influences *trust in e-gov*.
Hypothesis 5: *trust of government* positively influences *trust in e-gov*.
Hypothesis 6: *trust of the Internet* positively influences *trust in e-gov*.

One's perceptions of the risks associated with electronic transactions are a key constraint on their adoption (Dwivedi et al., 2017). Perceived risk is a subjective expectation presented by a citizen of experiencing a loss in their pursuit of a desired outcome (Gefen, Karahanna, & Straub, 2003; Warkentin et al., 2002). For the context of this paper, citizens' perceived risk is believed to be associated, in a particular way, with e-gov services and the risk involved in using these services.

This concept has been a determinant in the adoption and use of e-gov or e-commerce services (Dwivedi et al., 2017; Khattab, Al-Rawad, Al-Khattab, & Hamad, 2015; Munyoka & Maharaj, 2019; Verkijika & De Wet, 2018). Therefore, the citizen's perceived risk is associated with the user's negative feelings about using the system. This analysis in the present work takes place through the following hypotheses:

Hypothesis 7: *trust in e-gov* negatively influences the *perceived risk*.
Hypothesis 8: the *perceived risk* negatively influences the *intention to use*.

Other characteristics that act on trustworthiness in the individual trusted (trustee) and that appear more frequently in the literature and summarize the various facets of this phenomenon are ability, benevolence, and integrity (Mayer et al., 1995). These attributes will be addressed in more detail in the specific section below, considering also the third mode of trust generation, that is, the trusting individual's experience of the process being carried out and their direct interactions with the trusted individual (Zucker, 1986). Together, they represent important factors in the creation of Trust of Government.

2.2. Ability, benevolence, integrity and experience

The first most common characteristic in the literature about the qualities of the trusted individual (trustee) that generate Trust of Government is Ability, which can be summarized as the group of skills, expertise, competencies, and characteristics that allow a party to have influence over some specific domain (Mayer et al., 1995). This domain of ability is specific, and it happens because the individual being trusted may be competent in a specific technical area, which allows them to be trusted with tasks related to that specific technical area (Mayer et al., 1995).

The Ability construct is essential to understand citizens' perception of trustworthiness towards the Government (Beldad et al., 2011; Gao & Waechter, 2015; Janssen et al., 2018). It is important for citizens to have the perception of ability, competence, and efficiency of government officials and the rightness of their policy decisions so that there can be the development of Trust of Government (Levi

& Stoker, 2000). Therefore, we intend to analyze the influence of Ability on the perception of Trust of Government by the individual who trusts through the following hypothesis:

Hypothesis 9: the perception of *ability* positively influences *trust of government*.

The second most common characteristic in the trusted individual (trustee) literature that generates trustworthiness is Benevolence. It represents the extent to which the actions taken by the trusted individual (trustee) are believed to be aimed at seeking to do good to the trusting individual (trustor), i.e., the trusted individual who exhibits this characteristic has some specific attachment to the trusting individual, and the actions go beyond the self-centered pursuit of profit (Mayer et al., 1995). Thus, Benevolence is the perception of good motives, orientations, and positive intentions - or use the terms intentions, motives, and altruism synonymously - of the individual being trusted in relation to the trusting individual (Connolly, 2013; Mayer et al., 1995). This construct is used as an antecedent of Trustworthiness (Gao & Waechter, 2015; Tan et al., 2008). Therefore, we intend to analyze the influence of Benevolence on the perception of Trust of Government by the trusting individual through the following hypothesis:

Hypothesis 10: the perception of *benevolence* positively influences *trust of government*.

The third most common characteristic in the literature about the attributes of the trusted individual (trustee) that generate trustworthiness is Integrity. It is derived from the trusting individual's perception that the trusted individual will behave in a manner that indicates values that appear consistent and positive (Connolly, 2013). The relationship between integrity and trustworthiness involves the perception of the trusting individual that the individual being trusted will adopt a set of principles that they recognize or see as acceptable in that individual's actions (Mayer et al., 1995).

Some elements that the trusted individual may present that affect how their integrity is judged are the consistency of past actions, credible communication with other individuals, and the belief that the trusted individual has a strong sense of fairness and performs congruent and positive actions (Mayer et al., 1995). Although there may be different reasons why the integrity of a trusted individual may be perceived as higher or lower, when it comes to the assessment of trustworthiness, it is the perceived level of integrity that is important rather than the reasons why this perception is formed (Mayer et al., 1995; McFall, 1987).

Therefore, this construct is used as an antecedent of Trustworthiness (Gao & Waechter, 2015; Tan et al., 2008), and in this study, it is intended to analyze the influence of Integrity on the perception of Trust of Government by the trusting individual through the following hypothesis:

Hypothesis 11: the perception of *integrity* positively influences *trust of government*.

Trust increases over time, as the trusting individual (trustor) participates in repeated interactions with the trusted individual (trustee). Thus, the trustor accumulates information about the trustee in order to increase their trust in the trusted individual (Zucker, 1986). With experience, the trusting individual (trustor) collects credible information about the trusted individual (trustee) and the way

they behave in relationships that involve trust, in addition to assessing their trustworthiness and the possible consequences of these behaviors (McKnight et al., 2002).

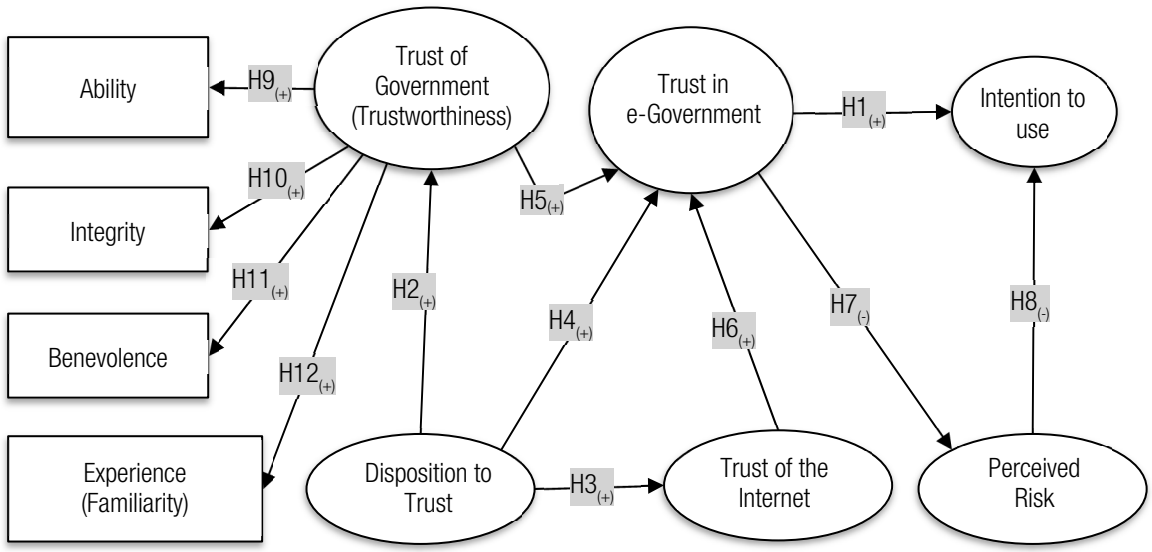
The experience or familiarity of the parties involved is probably the most important way in which trust is built (Zucker, 1986). Governments can build trust through experience when they convince their citizens that the same rigorous controls used for a given service are used for all other services, i.e., they are a behavioral pattern presented in the provision of services by electronic means (Warkentin et al., 2002). Therefore, we intend to analyze the influence of Experience in the perception of Trust of Government by the trusting individual through the following hypothesis:

Hypothesis 12: the perception of *experience* positively influences *trust of government (trustworthiness)*.

3. METHOD

This research is quantitative, with a cross-sectional approach to investigate the relationship proposed in the model of Figure 1. To operationalize the variables and, consequently, test the proposed hypotheses, an instrument (questionnaire) was used, composed initially of 36 items related to the constructs studied. For the measurement process, an 11-point Likert-type scale was used, ranging from 0 = "strongly disagree" to 10 = "strongly agree". Scales of 7 to 11 points are best for reflecting the variation in a population (Cox, 1980) and for obtaining higher validity of measurements (Andrews, 1984). The constructs were grounded theoretically based on literature review. Multi-item scales were developed, with translation and adaptation actions.

FIGURE 1 RESEARCH MODEL



Source: Elaborated by the authors.

All items or indicators that needed to be translated and adapted went through the alternative method of Back-Translation (Dias, 2016). This method is divided into two general steps. The first stage is called "Translation and Revision" and consists of: 1) making the translation into the desired language possible with the help of two professional translators; 2) consolidating the translated scale by a committee of experts in the constructs that the scale proposes to measure and with knowledge of the scale's original language; and 3) revising the scale, that is, discussing the understanding of the translated scale. The second stage is called "Empirical Verification" and consists of: 1) pre-testing the scale on a small sample of the target audience; 2) testing the scale on a sample of respondents and performing the relevant analyses of a research study; and, finally, 3) the researcher must choose whether or not to report the results to the academic community (Dias, 2016).

It is common in the e-gov literature to discuss how the data collection instrument should analyze e-gov services. There is both choosing specific services (e.g., Carter & Bélanger, 2005; Dwivedi et al., 2017; Warkentin et al., 2002; Warkentin et al., 2018) as well as analyzing e-gov as a whole, without having a specific service in mind (Alsaghier et al., 2009; Bélanger & Carter, 2008; Kurfali et al., 2017).

The latter approach was chosen in this research for the analysis of e-gov services. Thus, the respondent was asked to take as a reference most of their experiences with the following e-gov services when stating their answers: 1) personal documents (ID, CPF, passport or work card); 2) public health (scheduling appointments, medicines, others); 3) public education (Enem, Prouni, enrollment in public schools and universities); 4) worker rights or social security (INSS, FGTS, unemployment insurance, sickness benefit or retirement); 5) taxes and government fees (income, vehicle, property taxes etc.); 6) police and security (police report cards, criminal records or complaints); and 7) public transportation or urban services (cleaning, lighting and road maintenance).

For the accomplishment of data collection procedure, it was decided to carry out a survey using the electronic tool Google Forms and disseminated through social networks and contacts of the researchers. In addition to the items for measuring the constructs, the survey also included screening questions related to the profile of internet use and e-gov, as well as a sociodemographic description of the respondents.

The data collection period occurred between April 3 and May 10, 2020. The sampling strategy adopted was non-probabilistic and by convenience. This strategy was chosen for two reasons: 1) the online survey method can provide access to samples beyond the range that would be possible with other methods, and 2) this technique ensures efficiency in the way data is collected and handled, which allows the researcher to obtain larger sample sizes. There are inherent limitations to the convenience sampling technique that take away the researcher's ability to make inferences about the population (Etikan, 2016). However, considering the purpose of this research and to focus on the study's group of interest, it is understood that this strategy may be appropriate (Agresti & Finlay, 2009).

In total, 262 responses were collected. Only two cases did not contain all the answers and were eliminated from the sample. The others presented answers to all the items exposed in the form, totaling 260 valid cases. The socio-demographic profile is shown in Table 1. We can see a balance in the total number of respondents by gender, a higher concentration of individuals between 16 and 34 years old, with a medium or higher education level, and an income level of up to three minimum wages.

TABLE 1 DEMOGRAPHIC DISTRIBUTION OF RESPONDENTS

Gender	%	n
Female	53	138
Male	47	122
Age	**%**	**n**
10-15	0	0
16-24	53	139
25-34	35	91
35-44	6	15
45-59	1	2
60 plus	0	0
Did not Answer	5	13
Education Level	**%**	**n**
Illiterate/Preschool	0	0
Elementary/Middle School	0	0
High School	42	110
Higher Graduate	58	150
Family Income	**%**	**n**
Less than R$ 1.045 (1 MW)	26	68
R$ 1.046 - R$ 2.090 (1 - 2 MW)	33	85
R$ 2.091 - R$ 3.135 (2 - 3 MW)	16	42
R$ 3.136 - R$ 5.225 (3 - 5 MW)	7	17
R$ 5.226 - R$ 10.450 (5 - 10 MW)	7	17
R$ 10.450 (10 MW) plus	3	7
Did not Know	6	15
No income	3	9
Most used e-government services (last 12 months)	**%**	**n**
Public Education (Enem, Prouni, Enrollments)	58	151
Personal Documents (ID, CPF etc.)	41	106
Labor and Social Rights	30	77
Taxes (Income, Vehicle, Property etc.)	26	67
Others (Health, Security and Transportation)	50	129
Service Provision	**%**	**n**
Totally online	53	138
Partly online and partly face-to-face	28	74
Just searched information online	14	37
Service Motive	**%**	**n**
Legal Obligation	67	138
Spontaneous Interest	57	118

Source: Research Data.

Table 2 presents the descriptive measures of the constructs. The calculation of the aggregate value of the construct represents the arithmetic mean of the respective items that compose it. The construct with the highest aggregate mean was Trust in e-gov (mean = 7.29; dp = 1.92) and the lowest aggregate mean was Perceived Risk (mean = 3.64; dp = 2.49). In all constructs, the asymmetry and kurtosis values suggest a pattern of normality (Hair, Black, Babin, Anderson, & Tatham, 2009; Kline, 2016).

TABLE 2 DESCRIPTIVE STATISTICAL MEASURES

Construct	Num. of Items	Mean	Std. Dev.	Mode	Kurtosis	Skewness
Ability	6	5,89	2,15	7	0,39	-0,70
Benevolence	4	5,48	2,35	5	-0,02	-0,52
Integrity	5	5,98	2,27	7	0,28	-0,70
Experience	2	7,04	1,98	8	0,53	-0,70
Trust of Government	3	6,74	2,10	8	0,53	-0,80
Disposition to Trust	3	6,16	2,39	5	0,04	-0,54
Trust of the Internet	3	5,86	2,33	7	0,03	-0,54
Trust in e-gov	3	7,29	1,92	8	1,22	-0,97
Perceived Risk	2	3,64	2,49	2	-0,45	0,43
Intention to use	4	7,11	2,36	10	0,32	-0,80

Note: Aggregate values of the construct's items.
Source: Research Data.

To test the proposed model and verify the established hypotheses, the method used was Structural Equation Modeling by Partial Least Squares, which was conducted using the SmartPLS application (version 3). The results obtained are presented in the next topic.

4. RESULTS

In this section, we present the results concerning 1) the evaluation of the measurement model (convergent validity, discriminant validity and the trustworthiness of the constructs) and 2) the structural model that tests the hypotheses proposed in the paper.

The analysis of Table 3 shows that all constructs or latent variables of the structural equation model presented mean extracted variances (AVEs) greater than 0.5. Therefore, they had convergent validity (Fornell & Larcker, 1981). The analysis of Table 3 also shows that all constructs of the model presented Cronbach's Alpha and Composite Reliability values greater than 0.70, confirming the internal consistency of the scales used.

The cross loadings observed for the original latent variables are always higher than for other constructs. This result indicates Discriminant Validity (DV) by the first criterion (Chin, 1998). The

square roots of the AVEs (main diagonal) of all constructs or latent variables were higher than the Pearson correlations of these constructs with other latent variables, also indicating their Discriminant Validity (Fornell & Larcker, 1981), as shown in Table 3. Taken together, these analyses suggest that the measurement model is adjusted and that we can proceed to the structural model analysis.

TABLE 3 MODEL EVALUATION

	1	2	3	4	5	6	7	8	9	10
1 - BEN	0,932									
2 - ABI	0,737*	**0,907**								
3 - TOI	0,558*	0,538*	**0,928**							
4 - TEG	0,517*	0,56*	0,481*	**0,95**						
5 - TOG	0,606*	0,64*	0,603*	0,636*	**0,928**					
6 - DT	0,282*	0,339*	0,346*	0,301*	0,309*	**0,836**				
7 - EXP	0,283*	0,236*	0,339*	0,269*	0,355*	0,329*	**0,883**			
8 - INT	0,842*	0,854*	0,563*	0,583*	0,661*	0,318*	0,279*	**0,924**		
9 - USE	0,349*	0,364*	0,439*	0,527*	0,507*	0,424*	0,534*	0,35*	**0,827**	
10 - PR	-0,12	-0,094	-0,222*	-0,33*	-0,242*	0,013	-0,066	-0,112	-0,291*	**0,961**
CA	0,950	0,957	0,919	0,946	0,919	0,785	0,75	0,957	0,845	0,918
CR	0,964	0,965	0,949	0,965	0,949	0,874	0,876	0,967	0,895	0,960
AVE	0,869	0,823	0,861	0,902	0,861	0,698	0,78	0,855	0,683	0,924

Note 1: BEN: Benevolence; ABI: Ability; TOI: Trust of the Internet; TEG: Trust in e-gov; TOG: Trust of Government; DT: Disposition to Trust; EXP: Experience; INT: Integrity; USE: Intention to use; PR: Perceived Risk; CA: Cronbach's alpha; CR: Composite Reliability.
Note 2: The main diagonal values are the square roots of the AVE; as they are greater than the correlations between the latent variables (values outside the main diagonals), there is an indication of discriminant validity.
Note 3: * $p < 0,001$.
Source: Research Data.

According to Cohen (1988), when dealing with social and behavioral sciences, determination coefficients (R^2) with values of 0.02, 0.13 and 0.26 are classified as small, medium and large, respectively. Table 4 shows that the Trust of Government, Trust in e-gov and Intention to Use constructs have large coefficients of determination (R^2) ($R^2 \geq 0.26$). On the other hand, Trust of the Internet and Perceived Risk had small coefficients of determination ($0.02 \geq R^2 > 0.13$). The data in Table 2 indicate that all Predictive Validity (Q^2) or Stone-Geisser indicators were greater than zero.

According to Hair, Sarstedt, Ringle, and Hult (2016) and Bido and Silva (2019), effect size (f^2) values 0.02, 0.15, and 0.35 are considered small, medium, and large. In Table 4, it is observed that, despite 9 of the 12 hypotheses being supported, the effect sizes (f^2) were small in several proposed relationships, even though three of the five explained variances of the endogenous variables (R^2)

are considered large in the originally proposed model. These inconsistencies between results can be explained by multicollinearity problems, even though 11 of the 12 variance inflation factors (VIF) were below 5. It was also observed that three of the 12 variance inflation factors (VIF) are above 3.

According to Hair et al. (2016), the VIF value of each predictor should be less than 5. The authors also point out that, preferably, these values should be less than 3 so that there are no critical multicollinearity problems. Thus, with the analysis of the variance inflation factor (VIF) values presented in Table 4, possible multicollinearity problems can be observed due to VIF values higher than 3 in the predictor variables Benevolence, Ability, and Integrity. In the case of the latter variable, the value of its variance inflation factor (VIF) was greater than 5. Considering the results of Table 4, it was necessary to proceed with the estimation of alternative models in order to obtain the best possible explanation for the phenomenon under study. This procedure is described in the next topic.

TABLE 4 STRUCTURAL MODEL RESULTS

SR	HPT	SC	f^2	Q^2	VIF	SE	t	p-value	Adj. R^2
BEN > TOG	H10 (+)	0,124	0,009		3,482	0,099	1,249	0,212	
ABI > TOG	H9 (+)	0,260	0,035		3,797	0,099	2,638	0,008	
DT > TOG	H2 (+)	0,043	0,003	0,418	1,221	0,049	0,886	0,376	0,485
EXP > TOG	H12 (+)	0,168	0,047		1,178	0,049	3,389	0,001	
INT > TOG	H11 (+)	0,274	0,025		5,861	0,124	2,216	0,027	
TOI > TEG	H6 (+)	0,129	0,018		1,645	0,066	1,968	0,049	
TOG > TEG	H5 (+)	0,530	0,305	0,378	1,601	0,079	6,742	0,000	0,420
DT > TEG	H4 (+)	0,093	0,013		1,156	0,054	1,734	0,083	
TEG > USE	H1 (+)	0,483	0,295	0,182	1,122	0,050	9,705	0,000	0,288
PR > USE	H8 (-)	-0,132	0,022		1,122	0,058	2,284	0,022	
TEG > PR	H7 (-)	-0,330	0,122	0,097	1,000	0,058	5,695	0,000	0,105
DT > TOI	H3 (+)	0,346	0,136	0,101	1,000	0,062	5,573	0,000	0,116

Note 1: BEN: Benevolence; ABI: Ability; TOI: Trust of the Internet; TEG: Trust in e-Government; TOG: Trust of Government; DT: Disposition to Trust; EXP: Experience; INT: Integrity; USE: Intention to use; PR: Perceived Risk.
Note 2: SR: Structural Relations; HPT: Hypothesis; SC: Structural Coefficient; SE: Standard Error.
Source: Research Data.

4.1. Model comparison

In order to try to solve the multicollinearity problems identified, the first procedure adopted was to remove the Disposition to Trust variable from the original model. The justification for this procedure stems from the fact that this construct presented problems in some structural adjustment parameters. Moreover, from a theoretical point of view, Bélanger and Carter (2008) state that this disposition is especially important in the early stages of a relationship, and as citizens increasingly acquire information about the benefits and consequences of completing online transactions with the government, this disposition would have less impact. After the construct was removed, it was noted that this version of the model still exhibited multicollinearity problems, as it also showed high variance inflation factors (VIF) - values above 5 - and low values in Cohen's indicators (f^2) or effect sizes - values below 0.15. Thus, there was again a need for further alternative model estimation.

According to Hair et al. (2016) and Bido and Silva (2019), there are two ways to resolve these inconsistencies. The authors recommend: 1) eliminate two of the three predictors that had higher correlations with each other and/or 2) group them into a second-order latent variable. The constructs that presented multicollinearity problems were 1) Ability, 2) Benevolence, and 3) Integrity. All are predictors of the Trust of Government construct. From an empirical point of view, it was observed that these three latent variables are highly correlated and have the highest variance inflation factors (VIF) of the originally proposed model. From a theoretical point of view, the three constructs describe possible characteristics that should be worked on in government actors to show trustworthiness and, therefore, express close ideas and concepts that can make them highly correlated.

In order to apply the possible forms of solution proposed by Hair et al. (2016) and Bido and Silva (2019), six more alternative models were tested sequentially with only one predictor variable of Trust of Government at a time (Ability, Benevolence, and Integrity). These models were estimated without and with the Disposition to Trust construct. However, it was observed that this construct posed problems for the overall fit of all alternative models tested. The alternative models with only one predictor variable at a time and without the Disposition to Trust construct showed much better adjustment measures than the model originally proposed in the research. The problems with VIF values were solved, i.e., all values were below 3. Regarding effect size (f^2), improvements were also observed in the results.

For Hair et al. (2016) and Bido and Silva (2019), another way to solve these inconsistencies is to create a second-order latent variable. According to the authors, a second-order latent variable is measured by two or more first-order latent variables and, in the case of Structural Equation Modeling by the partial least squares method, if the latent variable has no measurement variables connected to it, the algorithm does not start its iterations. Thus, it was decided to rethink how to operationalize the first-order variables Ability, Benevolence, Integrity, and Experience into second-order variables in order to find the configuration that would provide the best overall model adjustment. This procedure was operationalized in two ways: 1) the indicator repetition method and 2) the two-step method.

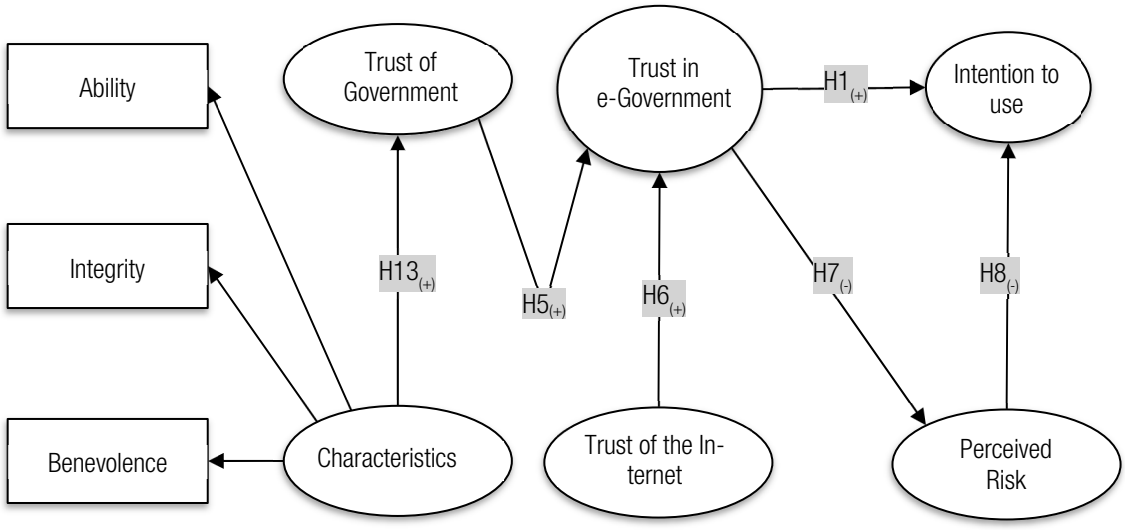
Thus, it was observed that both approaches solved the multicollinearity problem found in the original model proposed in the paper, requiring a modification in the conceptual model: defining the second-order latent variable and revising the hypothesis (structural relationship). It is intended to analyze the new relationship that arises with the operationalization of the second-order variable between Characteristics and Trust of Government through the following hypothesis:

Hypothesis 13: the *characteristics* of the government positively influences *trust of government (trustworthiness)*.

Although the second-order latent variables make the measurement model operationally more complex, their use is justified by the better adjustment obtained and by enabling closer approximation with the basic theory established in this research. The model with the best measurements of accuracy was the one that 1) used the two-step method to operationalize the second-order variable, 2) did not contain the latent variable or construct "Disposition to Trust" and 3) did not use the latent variable or construct "Experience".

The following shows 1) the final alternative model proposed in the research in Figure 2, 2) the results of the measurement model of that model, and 3) the results of the structural model.

FIGURE 2 ALTERNATIVE RESEARCH MODE



Note 1: *Characteristics* is a second order variable.
Note 2: The indicators of the latent variable *Characteristics* are the factor scores of the first-order latent variables.
Source: Elaborated by the authors.

Tables 5 and 6 show the results concerning 1) measurement model evaluation (convergent validity, discriminant validity and construct reliability) and 2) structural model analysis of the alternative that presented the best adjustment results.

The analysis of Table 5 shows that all constructs or latent variables of the structural equation model presented AVEs (Average Extracted Variances) greater than 0.5. Therefore, they had convergent validity (Fornell & Larcker, 1981). The analysis of Table 5 also shows that all constructs in the model presented Cronbach's Alpha and Composite Reliability values greater than 0.70. These results confirm the internal consistency of the model and the internal consistency of the scales used.

TABLE 5 MODEL EVALUATION

	CAR	CFI	CEG	CGO	INU	RPE
CHA	**0,935**					
TOI	0,591	**0,928**				
TEG	0,592	0,481	**0,95**			
TOG	0,679	0,604	0,636	**0,928**		
USE	0,378	0,438	0,527	0,507	**0,827**	
PR	-0,115	-0,224	-0,33	-0,242	-0,291	**0,961**
AC	0,928	0,919	0,946	0,919	0,845	0,918
CC	0,954	0,949	0,965	0,949	0,895	0,960
AVE	0,874	0,861	0,902	0,861	0,683	0,924

Note 1: CHA: Characteristics; TOI: Trust of the Internet; TEG: Trust in e-gov; TOG: Trust of Government; USE: Intention to use; PR: Perceived Risk; CA: Cronbach's alpha; CR: Composite Reliability. AVE: Average Variance Extracted.
Note 2: The main diagonal values are the square roots of the AVE; as they are greater than the correlations between the latent variables (values outside the main diagonals), there is an indication of discriminant validity.
Source: Research Data.

The crossloadings observed for the original latent variables are always higher than for the other constructs. This result signals Discriminant Validity (DV) by Chin's (1998) criterion. The square roots of the AVEs (main diagonal) of all constructs or latent variables were greater than the Pearson correlations of these constructs with other latent variables, also indicating their Discriminant Validity, as shown in Table 5 (Fornell & Larcker, 1981). These analyses, taken together, suggest that the measurement model is adjusted and one can proceed to the structural model analysis.

TABLE 6 STRUCTURAL MODEL RESULTS

ST	HPT	SC	f²	VIF	SE	t	p-value	Adj. R²	Q²
TOI > TEG	H6	0,153	0,026	1,573	0,067	2,294	0,022	0,415	0,372
CGO > TEG	H5	0,544	0,324	1,573	0,078	6,960	0,000		
PR > USE	H8	-0,132	0,022	1,122	0,056	2,370	0,018	0,288	0,182
TEG > USE	H1	0,483	0,295	1,122	0,050	9,583	0,000		
CHA > TOG	H13	0,679	0,858	1,000	0,041	16,588	0,000	0,460	0,393
TEG > PR	H7	-0,330	0,122	1,000	0,059	5,543	0,000	0,105	0,097

Note 1: CHA: Characteristics; TOI: Trust of the Internet; TEG: Trust in e-gov; TOG: Trust of Government; USE: Intention to use; PR: Perceived Risk.
Note 2: SR: Structural Relations; HPT: Hypothesis; SC: Structural Coefficient; SE: Standard Error.
Source: Research Data.

Table 6 shows that the constructs Trust of Government, Trust in e-gov and Intention to Use showed large coefficients of determination (R^2) with large effects ($R^2 \geq 0.26$). The Perceived Risk construct had a low coefficient of determination ($0.02 \leq R^2 < 0.13$). The data in Table 6 indicate that all relationships are significant, as the t-values were greater than 1.96 and all p-values were less than 0.05. The data in Table 6 also show that all Predictive Validity (Q^2) or Stone-Geisser indicators were greater than zero.

It was observed that in the alternative model, none of the relationships were considered irrelevant ($f^2 < 0.02$), three relationships were considered small ($0.02 \leq f^2 < 0.15$), two relationships were considered medium ($0.15 \leq f^2 < 0.35$), and finally, one relationship was considered large ($f^2 \geq 0.35$) (Hair et al., 2016). Table 6 indicates that all the values of the VIFs were less than 3. This result evidences an improvement over the original model and will be taken as the basis for the discussion of the hypotheses.

4.2. Discussion

With the operationalization of the alternative model, the Disposition to Trust and Experience constructs were removed from the model, generating implications for the hypotheses originally established. However, some considerations must be made in this regard. Regarding the Disposition to Trust hypotheses (H2, H3, and H4), Bélanger and Carter (2008) argue that e-gov initiatives were still in the early stages when their research was conducted and, therefore, citizens had not yet acquired significant information about the benefits and consequences of completing transactions with government online.

Bélanger and Carter (2008) further argue that the Disposition to Trust is especially important in the early stages of a relationship. This may explain the result found here because, according to this logic, as citizens begin to understand the importance, benefits and consequences of e-gov, the predisposition to trust would become less relevant to the generation of trust in e-gov services. Colesta

(2009), on the other hand, points out that people with different life backgrounds, personality types, and cultural backgrounds vary in their dispositions to trust. The findings may signal that e-gov services have reached their maturation phase and popularization among citizens, as they have already passed through the initial phase of a relationship in which the predisposition to trust would play an important role.

With the operationalization of the second-order variable, it was necessary to rethink the influence of the Ability, Benevolence, Integrity, and Experience constructs. This last attribute was removed from hypothesis 12, which allows for a better adjustment. From an objective perspective, hypotheses 9, 10, and 11, therefore, can be discussed together, taking as reference that they represent government characteristics that influence Trust of Government. Thus, hypothesis 13 was supported. It suggests a relationship between Government Characteristics and Trust of Government. As a whole, the result obtained dialogues with what is proposed by Zucker (1986), who states that, for the generation of trust, one must consider the characteristics of the actors involved.

Hypotheses 5 and 6 were supported. Hypothesis 5 suggests a relationship between Trust of Government and Trust in e-gov. Hypothesis 6 indicates a relationship between Trust on the Internet and Trust in e-gov. These results are similar to those of Colesta (2009), who found a positive relationship between trust in technology and trust in e-gov. Teo et al. (2009) found a positive association between trust of the government and trust in an e-gov website.

Hypotheses 7 and 8 were supported. Hypothesis 7 implies a negative relationship between Trust in e-gov and Perceived Risk, while hypothesis 8 demonstrates a negative relationship between Perceived Risk and Intention to Use. These results reveal that perceived risk and trust are strongly interrelated and are similar to those of Horst et al. (2007), who concluded that perceived risk in e-services has a significant negative influence on trust in e-gov. Munyoka and Maharaj (2019) and Verkijika and De Wet (2018), meanwhile, found that perceived risk has significant negative influence on usage attitude.

Finally, hypothesis 1 was supported. It is taken as the main hypothesis of this study and suggests a positive relationship between Trust in e-gov and Intention to Use. With this result, it can be suggested that trust plays an important role in citizens' intention to use e-gov services and it should be considered by government agencies. Governments have particularities when it comes to online activity in that they have the power to prescribe rules and regulations and thus create legal obligations for their activities. While this use of power can make citizen use of e-gov mandatory, it can also likely frustrate citizens because of their dependence on and lack of control over government actions. Given these circumstances, trust-building should be considered a preferred alternative because it makes it easier for citizens to choose to perform services online (Warkentin et al., 2002).

5. CONCLUSION

The objective that guided this work was to investigate the role of trust in the adoption and use of the e-gov resource. To this end, a structural model was proposed considering the relationship among the Ability, Benevolence, Integrity, Experience, Perceived Risk, Trust of Government, and Disposition to Trust constructs. The results found in the study indicate the influence of Trust in e-gov and Trust of Government as important factors for the adoption and use of electronic government services.

Considering the theoretical perspective used, as postulated by the hypotheses, it is observed that there is a negative relationship between Trust in e-gov and Perceived Risk and also between Perceived Risk and Intention to Use. All other path coefficient relationships were positive, both between the indicators and their latent variables and between the latent variables. All these results suggest the model's consistency with the literature.

From a theoretical and practical point of view, one can reflect on what leads citizens to use online services, especially when making this type of service provision an alternative to traditional in-person service, for example. After all, in the implementation of governmental actions, manifested in the form of public policies, there is the involvement of a diverse set of actors in which governmental actions, behavior, and decisions have great influence not only in the way they are produced, but also in their content and results (Pires, 2017).

In this context, it is understood that e-gov is a faster and more practical alternative for citizens and a facilitator of government services. However, it is necessary to reflect on the factors that encourage or discourage its use by citizens. Individuals who consider the use of e-gov systems risky tend to avoid them and switch to the traditional means of in-person provision. In other words, for e-gov systems to become an important channel of access to government services, it is essential that all the issues and perceptions surrounding risk are comprehensively addressed. Thus, privacy, security, and trust are key to neutralizing perceived risk and dictating the degree of success of e-gov systems (Munyoka & Maharaj, 2019).

This means that citizens need to believe in mechanisms - which must effectively exist - that can guarantee an impersonal, private and secure way of transmitting data that are involved in transactions conducted electronically with government bodies and agencies. One way to do this is to make use of the trust-building mechanisms that are already used by vendors in e-commerce, such as the publication of security and privacy seals, which can encourage the creation of trust in e-gov. Another interesting measure would be to convey and publish a history of successful e-services, and also to release statistics on their beneficial outcomes and citizens' satisfaction with the services provided.

Belanger and Carter (2008) point out that the disposition to trust is a personal propensity that government agencies cannot manipulate. However, e-gov service providers must be aware of its existence and its impact on other, more flexible modes of trust, such as trust of the internet and trust of government. By nature, some citizens are more reluctant and skeptical of using e-gov services than others. Thus, those with a lower propensity to trust represent the greatest opportunity for growth in e-gov adoption. Government agencies must strive to reach this specific group of citizens to get the greatest return on what is invested in information technology (Belanger & Carter, 2008).

Government agencies can provide incentives for citizens to try e-gov services. Thus, perhaps an agency could ensure that the online form of provision is faster than traditional ones. Consequently, once a citizen has a successful and rewarding experience with this system of service provision, they will begin to develop trust in both the Internet and the government. This may increase their willingness to use e-gov services in the future (Belanger & Carter, 2008).

Therefore, when taking into consideration the results presented here, as government agencies increase spending to implement and maintain these initiatives, it is imperative that they also recognize the issues of trust and confidence in e-gov and address them. This may allow policy makers to use

resources more efficiently by working out more effective ways to attract citizens to use services over the Internet.

6. LIMITATIONS AND RESEARCH AGENDA

It is important to point out that the main purpose of this study was not to propose definitive solutions to the issues presented. In other words, this study has limitations. Obviously, further research is necessary to expand the knowledge and understanding of the analyzed phenomenon. First, it is necessary to reflect on the procedure used to collect primary data. Because of the restrictions arising from the period in which it took place, in the initial context of the COVID-19 pandemic, the survey was applied exclusively through the internet and with a convenience strategy. This factor represents a limitation on the range of respondent and e-gov user types that the survey could reach and on their experience with e-gov, as well as on the ability to generalize the results. However, it represented the most appropriate way to circumvent the problems arising from the public health crisis and obtain a larger number of respondents.

Second, one can also reflect on how the measurement process occurred. It is well known that the method of translating terminology used in academic research does not always find the best match in different languages. Furthermore, it is possible to question whether the items used are able to measure what was actually intended. In other words, considering this process, cultural differences may exert influence and generate potential biases in the results. For example, individuals residing in different locations may have different evaluations and expectations about what it means to trust the State apparatus.

For this reason, this study was concerned with using validated scales published in peer-reviewed articles in reputable journals. The adequacy and adaptation of the items went through more than one round with translators and specialists to verify face and content validity, which subsidized the final wording of the items and their adequacy to the concepts. Although we recognize that this choice is not something that can be taken for granted, we still believe that it is a more appropriate path than developing new measures, since it reduces costs, development time, and may be more appropriate for cross-cultural comparisons (Gjersing et al., 2010).

These two limitations open up opportunities for further studies that might be applied by means of personal interviews with respondents, attempting, for instance, to verify how the phenomenon under study is perceived based on a more individualized perspective or even considering the post-pandemic context of COVID-19. For example, it is possible to ask how certain expectations manifest themselves in relation to trust in e-gov in particular groups, whether by locality or level of use, or by experience of what the government offers via the Internet. That is, it would also be possible to add information and knowledge about people who do not use electronic means of interaction.

Finally, it is worth reflecting on the choice of how trust in e-gov was framed in this research. That is, whether it is a necessary condition and requires the overcoming of a minimum level to be reflected in usage intention or whether it can be treated as a sufficiency condition. In this paper, the second approach was chosen, believing that the more trust, the more intention there may be for an individual to use e-gov. However, this opens an opportunity for further studies to frame the phenomenon under the first condition, verifying the reflexes on the results and hypotheses established here.

Furthermore, in the specific literature of the field, research tends to either choose a specific service to do the analysis of e-gov as a whole or choose to do the analysis of e-gov as a whole without having a specific service in mind. This can be regarded as a limitation for some scholars or just a research design decision for others. In the present text, it was preferred to adopt the second option. Therefore, the results obtained and the conclusion established do not reach reflections that concern mandatory or non-mandatory choices.

For example, some population strata are required to do their tax returns and collect taxes over the Internet, leaving no alternative but to take this course of action. On the other hand, other services offered by the Government have their respective in-person counterpart, representing a choice for the individual's course of action. Thus, it is important to highlight this condition and, as a suggestion for further research, the application and adaptation of the model's data collection instrument for the context of a specific e-gov service, in order to verify how the hypotheses, behave under this condition.

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