Intention to adopt Electronic Animal Movement Permit (e-GTA) systems in Rio Grande do Sul, Brazil[1]

Bernardo Todeschini[2]*, Leonardo W. Isolan[2], Diego V. Santos[3],
Antônio C.G. Maçada[4] and Luís Gustavo Corbellini[5]

ABSTRACT.- Todeschini B., Isolan L.W., Santos D.V., Maçada A.C.G. & Corbellini L.G. 2020. **Intention to adopt Electronic Animal Movement Permit (e-GTA) systems in Rio Grande do Sul, Brazil.** *Pesquisa Veterinária Brasileira 40(9):677-684.* Superintendência Federal de Agricultura no Rio Grande do Sul, Ministério da Agricultura, Pecuária e Abastecimento, Av. Loureiro da Silva 515/701, Porto Alegre, RS 90010-420, Brazil. Email: bertodeschini@gmail.com

Control of livestock and their movement has long been recognized as a crucial for the prevention and control of diseases. In Brazil, the control of livestock movement established in 1934. Since 1995 is regulated based on the Animal Movement Permit (GTA). Since then, the process has been improved and updated on its legal framework and strategies, including the use of emerging technological alternatives, which made possible the launching of the electronic Animal Movement Permit (e-GTA) in 2011. From a broader perspective, the e-GTA is inserted in a global context of the development of Information and Communication Technology (ICT) which since the early 1980s enabled governments worldwide to drive policies for the development of electronic government systems (e-government). After that, at a global level, there was an expansion and improvement of e-government services; however, discrepancies among countries persisted. Nonetheless, the levels of adoption of e-government by citizens have been lower than those expected by government authorities, which has attracted the attention of researchers in the area. In this context, studies of this nature that used theoretical antecedents related to the adoption of ICT have exposed peculiarities of the process of adoption of e-government, demanding research efforts directed to the structuring of specific models for this area. In Brazil, studies of this nature are still at an early stage, although government actions aimed at e-government date back to the 1990s. The objective of this article was to investigate, in an exploratory way, influence factors on the adoption intention of e-government related to animal health, having the e-GTA as the object of research. The conceptual framework was defined based upon the e-Government Adoption Model (GAM) For this objective, an online questionnaire oriented to intention to adopt e-GTA was applied to equine owners of Rio Grande do Sul not users of this system. Results indicated that respondents positively evaluated the quality of their computers and cellphones, as well as their efficacy to operate them, while quality of the internet connection was considered regular. In this context, the availability of computer and cellphone resources and computer self-efficacy did not influence the intention to adopt e-GTA. Moreover, aspects related to compatibility of e-GTA with users lifestyle have a positive association with the intention to adopt e-GTA. Also the study indicated that public information campaigns could contribute to the improvement of adoption of the e-GTA. Additionally, the authors suggested that further investigations considering other livestock sectors and variables, as well as the continuity of use after the adoption, could contribute to the expansion of the knowledge on this field.

INDEX TERMS: e-government, e-GTA, Animal Movement Permit, Information and Communication Technology, ICT, animal health, animal movement, public policies, Rio Grande do Sul, Brazil.

[1] Received on March 15, 2020.
Accepted for publication on March 31, 2020.

[2] Superintendência Federal de Agricultura no Rio Grande do Sul, Ministério da Agricultura, Pecuária e Abastecimento, Av. Loureiro da Silva 515/701, Porto Alegre, RS 90010-420, Brazil. *Corresponding author: bertodeschini@gmail.com

[3] Departamento de Saúde Animal, Ministério da Agricultura, Pecuária e Abastecimento, Esplanada dos Ministérios, Bloco D, Anexo B, Sala 333, Brasília, DF 70043-900, Brazil.

[4] Escola de Administração, Universidade Federal do Rio Grande do Sul (UFRGS), Rua Washington Luiz 855, Porto Alegre, RS 90010-460, Brazil.

[5] Departamento de Medicina Veterinária Preventiva, Faculdade de Veterinária, Universidade Federal do Rio Grande do Sul (UFRGS), Av. Bento Gonçalves 9090, Porto Alegre, RS 90040-060, Brazil.

RESUMO.- [**Intenção de adoção de Guia de Trânsito Animal Eletrônica (e-GTA) no Rio Grande do Sul, Brasil.**] O controle dos estoques e de movimentações de animais pecuários há muito tempo é reconhecido como um fator crucial para a prevenção e resposta para a introdução e disseminação de doenças animais ou zoonóticas. No Brasil, o controle de movimentação animal foi inicialmente estabelecido em 1934 e, desde 1995, é regulamentado com base na Guia de Trânsito Animal (GTA). Desde então, o processo foi aprimorado e atualizado em seu arcabouço legal e estratégias, inclusive no uso de alternativas tecnológicas emergentes, que possibilitaram o lançamento em 2011 da Guia de Trânsito Animal Eletrônica (e-GTA). Considerado desde uma perspectiva mais abrangente, o e-GTA está inserido em um contexto global de desenvolvimento da Tecnologia da Informação e Comunicação (TIC), que desde o início dos anos 80 permite que governos em todo o mundo conduzam políticas para o desenvolvimento de sistemas de governo eletrônico (governo eletrônico). Posteriormente, a disponibilidade do governo eletrônico tem estado em expansão de qualidade e de amplitude dos serviços oferecidos, embora este processo seja permeado por desigualdades entre os países. No entanto, os níveis de adoção do governo eletrônico pelos cidadãos têm sido inferiores aos esperados pelas autoridades governamentais, o que tem atraído a atenção dos pesquisadores da área. Nesse contexto, estudos dessa natureza, que utilizaram antecedentes teóricos relacionados à adoção das TIC expuseram idiossincrasias do processo de adoção do governo eletrônico, exigindo que esforços de pesquisa sejam direcionados à estruturação de modelos específicos para essa área. No Brasil, estudos dessa natureza ainda estão em estágio inicial, embora as ações governamentais direcionadas ao governo eletrônico datem dos anos 90. Dessa forma, o objetivo deste artigo foi investigar, de forma exploratória, fatores de influência na intenção de adoção do governo eletrônico relacionado à saúde animal, tendo o e-GTA como objeto de pesquisa. A estrutura conceitual foi definida com base no Modelo de Adoção de Governo Eletrônico (GAM). Para esse objetivo, um questionário online dirigido à intenção de adoção do e-GTA foi aplicado a proprietários de equinos do Rio Grande do Sul que não eram usuários deste sistema. Os resultados indicaram que os entrevistados avaliaram positivamente a qualidade de seus computadores e telefones celulares, bem como sua eficácia em operá-los, enquanto a qualidade da conexão de internet foi considerada regular. Nesse contexto, a disponibilidade de recursos informáticos e de celulares, bem como a capacidade de operação dos mesmos não influenciaram a intenção de adoção do e-GTA. Além disso, aspectos relacionados à compatibilidade do e-GTA com o estilo de vida do usuário têm uma associação positiva com a intenção de adoção do e-GTA. Além disso, o estudo indicou que as campanhas de informação pública poderiam contribuir para o incremento na adoção efetiva do e-GTA. Finalmente, o estudo identificou oportunidades para o desenvolvimento de investigações adicionais, considerando distintas variáveis, setores produtivos e sistemas de governo eletrônico dirigidos à saúde animal, o que poderia contribuir para a expansão do conhecimento nesta área.

TERMOS DE INDEXAÇÃO: Governo eletrônico, e-GTA, Guia de Trânsito Animal, Tecnologia da Informação e Comunicação, TIC, saúde animal, movimentação animal, políticas públicas, Rio Grande do Sul, Brasil.

INTRODUCTION

The control of stocks of livestock on farms and their movements has long been recognized as a crucial factor for the investigation of introduction and spread of diseases in domestic and wild animals, being even a determining factor in the creation of the World Organization for Animal Health (OIE 2017). The importance of these issues and the challenges to their implementation are widely recognized by academic institutions, governments, and non-governmental organizations dedicated to animal health (Woodford 1993, FAO 2002, Mansley et al. 2003, Fèvre et al. 2006, USDA 2014, Santos et al. 2017, Todeschini et al. 2018).

In Brazil, the control of livestock movements was initially regulated by the Decree No. 24.548/1934, which established the obligation to carry a sanitary document for the movement of animals, attesting their good health to protect national herds (MAPA 1934). For the effectiveness of movement control, further mechanisms have been established (MAPA 1977, 1986), such as the Animal Movement Permit, (GTA) implemented in 1995 (MAPA 1995), which is currently used. GTA is based on the control of cargo movements where a single GTA allows the movement of one or more animals from a same origin and moving simultaneously to a common recipient. GTA was originally conceived as a paper formulary issued by the Official Veterinary Service of each State (OVS), to which was later incorporated the legal possibility of use in electronic format, called e-GTA (MAPA 2011). Coordinated with this process, the control of holdings, producers and their of livestock has been progressively changed to digital systems, which, in some states, allow their users to consult and update their data, as well as issuing e-GTAs, as in Mato Grosso do Sul (SANIAGRO system) (IAGRO 2018), and Rio Grande do Sul (RS) (SDA system) (SEAPDR-RS 2019). In this context, presently GTAs may be issued according to three procedures: at local veterinary units of the OVS, performed by public servants and upon face-to-face producer request and issued as a paper formulary; online systems, available by state SVOs and carried out directly by the interested producers; and by accredited private veterinarians, who may issue GTA for some species and animal categories using both paper formularies or through the aforementioned online systems.

The e-GTA is inserted in a global context of development of Information and Communication Technology (ICT), which since 1980's has enabled governments to start offering online services to their citizens (Zhigang & Fengyue 2016) in a process referred as "Electronic Government", or simply "e-government" (De Róiste 2013). In Brazil, e-government initiatives were first implemented from the end of the 1990s, (Laia et al. 2011), being formally systematized by the launching of the State Electronic Government Program in 2000 (Brazil 2017). This program led to several e-government initiatives at the federal level, which presently offers around 800 services centralized in a Portal Services (Brazil 2019). Nonetheless, e-government initiatives were often misaligned with global public policies and ended by hampering their attractiveness as an alternative to be adopted by citizens (Chahin et al. 2004, Laia et al. 2011). In addition, the efforts were mainly directed to the technological structure of services, leaving a gap of understanding of the perspective of the users which finally jeopardize the adoption of e-government (Laia et al. 2011, Weerakkody et al. 2013).

Although e-government may have a positive impact on the corruption, government transparency and citizen convenience, bringing greater global efficiency to all parties (World Bank 2017), the levels of adoption of these services continue to be lower than expected (Lallmahomed et al. 2017), which after decades of investment could be considered as an "e-government paradox" (Savoldelli et al. 2014). This may be the situation of e-GTA in the RS state, as in 2016 approximately a total of 1,400,000 GTAs were issued for the movement of around 300 thousand horses, 7 million cattle, 11 million pigs and 900 million birds, and out of which less than 10% used the e-GTA system (Vergara 2017).

The ICT adoption and its continued use has interested researchers since the early 1960s, generating various theories and models, such as Diffusion of Innovation Theory - DOI (Rogers 2003), Technology Acceptance Model - TAM (Davis 1989), Task-Technology Fit (Goodhue & Thompson 1995) and Unified Theory of Acceptance and Use of Technology - UTAUT (Venkatesh et al. 2003). In general, researches on ICT adoption presupposes that potential users of a given ICT, including e-government, evaluate the potential benefits and harms that may result from the use of this technology in the final decision of adoption or rejection (Shareef et al. 2009, Al-Jabri & Roztocki 2014, Kumar et al. 2017). In this context, it must be considered that the availability and use of e-government has shown a global trend of expansion (United Nations 2016), although the adoption of these services continue at levels lower than those desired by the public managers (Savoldelli et al. 2014, Ma & Zheng 2018), resulting in a waste of taxes from society itself (Ozkan & Kanat 2011).

In a field study developed in Canada aimed at the adoption of e-government by citizens and business organizations, Shareef et al. (2011) found that most of the academic models were essentially conceptual, with a research gap on empirical studies with real users for validation and generalization of these models. Those authors tested the influence of 11 constructs on two distinct moments of adoption of e-government, reflecting the degree of interaction and exchange of information of the users with the systems. Results suggested that the adoption

of e-government varies according to the maturity of their existence in a given society and led to the proposition of the e-government Adoption Model (GAM).

However, many researchers agree that there is still a lack of conceptual and empirical studies in e-government which could support the development of this area (Shareef et al. 2011, Snead et al. 2014, Alcaide-Muñoz et al. 2017, Tursunbayeva et al. 2017). Considering this aspect, the objective of this article was to investigate factors related to the adoption intention of e-government services in RS state, focusing intention to adopt e-GTA made available by the "Secretaria da Agricultura, Pecuária e Desenvolvimento Rural" of the Rio Grande do Sul State (SEAPDR-RS).

MATERIALS AND METHODS

The present study departs from the conceptual model established by Shareef et al. (2011) for the e-government Adoption Model - GAM. The decision for the alignment with the GAM was because it is specifically directed to studies related to the adoption of e-government, which is the object of the present study. In this context, it aimed to evaluate the influence of three constructs related to the initial stage of adoption of e-government in the intention to adopt animal health e-government, as declared by the respondent. The conceptual model used in the present study is presented in Figure 1, while the theoretical bases of questions addressed to each evaluated construct are presented in Table 1.

Hypothesis formulation. Several researchers on e-government have argued that the adoption of those services, being computer
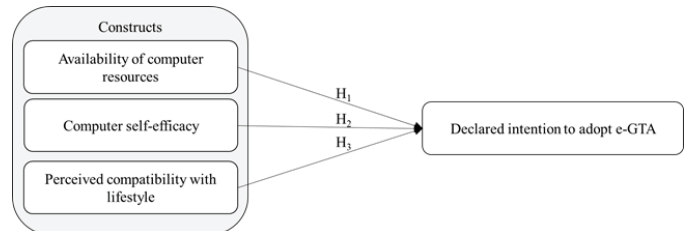

Fig.1. Conceptual model adopted in the study.

Table 1. Theoretical structure of the questionnaire

Construct	Question	Theoretical references
Perceived awareness of e-government	1. I have heard about the electronic system of GTA (e-GTA) of RS 2. I have heard of about the website of SEAPDR-RS 3. I have already visited the website of SEAPDR-RS	Anthopoulos et al. 2007, Shareef et al. 2009, Shareef et al. 2011, Lallmahomed et al. 2011.
Availability of resources	4. The internet connection of my computer is very good 5. The computer I use is very good 6. The internet connection of my cell phone is very good 7. The cell phone I use is very good	Van Dijk et al. 2008, Shareef et al. 2011, Lallmahomed et al. 2011.
Computer self-efficacy	8. I know how to use my computer and / or cell phone very well. 9. I master the use of the internet 10. I know very well how to use government systems available on the Internet (e.g. traffic authority, income and taxes, etc.)	Anthopoulos et al. 2007, Kumar et al. 2007, Shareef et al. 2009, Shareef et al. 2011.
Perceived compatibility with lifestyle	11. As far as I know, the information available on the SEAPDR-RS website about e-GTA are clear and useful 12. By the information of the enunciation, the e-GTA could be useful for me 13. By the information of the enunciation, e-GTA applies to my lifestyle	Davis 1989, Davis et al. 1989, Delone & Mclean et al. 1992, Chau & Hu 2001, Venkatesh et al. 2003, Carter & Bélanger 2005, Anthopoulos et al. 2007, Shareef et al. 2007, Wang & Liao 2008, Lallmahomed et al. 2011, Shareef et al. 2011, Al-Hujran et al. 2015, Kumar et al. 2018.
Declared adoption intention	14. I would be interested in using e-GTA	Shareef et al. 2011, Al-Hujran et al. 2015.

and internet-based, are dependent on the availability of informatics equipment and internet access, and as well as a certain degree of competence on both digital resources and internet navigation (Van Dijk et al. 2008, Shareef et al. 2011, Lallmahomed et al. 2017, Verkijika & De Wet 2018). Considering these previous researches, then we proposed hypothesis 1: the availability of computer resources positively influences the declared intention to adopt e-GTA.

Researches on ICT adoption have been proposing that the intention to adopt e-government is influenced by the ability of the user to properly perform the operational stages to go online, access, navigate on systems and achieve desired goals (Davis 1989). Persons with high computer self-efficacy are prone to have a positive perception of experiences of ICT and become users (Mensah & Mi 2019). Based on these arguments, we propose hypothesis 2: computer self-efficacy positively influences the declared intention to adopt e-GTA.

Researches on ICT adoption have demonstrated that the compatibility of the technology with the user's lifestyle is determinant on the adoption intention (Rogers 2003, Kumar et al. 2018). This construct has cultural, behavioral, and social aspects, and has been used as a predictor of e-government adoption (Carter & Bélanger 2005, Anthopoulos et al. 2007, Kumar et al. 2018). Based on this argument, we formulated the hypothesis three: perceived compatibility with lifestyle has a positive influences on the declared intention to adopt e-GTA.

Research instrument, data collection and target population. The study adopted a multi-method approach, understanding that the combination of different research methods is possible and interesting for the development of the work (Tashakkori & Teddlie 1998, Teddlie & Tashakkori 2006). In this way, it consisted of a qualitative and a quantitative phase.

In the initial qualitative phase, semi-structured interviews were conducted with four professionals with management positions in four associations of equine breeders in RS, applied in July 2017. The interview script was aimed at identifying sociodemographic, associative and habits aspects that could be relevant to be included in the subsequent quantitative phase.

Based on the results of the semi-structured interviews and on the work of Shareef et al. (2011), a preliminary questionnaire was developed using the Qualtrics® platform. The preliminary version was submitted to the evaluation of four experts, non-participating in the abovementioned interviews and selected by the authors based on their expertise in at least one of the following areas: research on ICT management; research on epidemiology applied to Official Veterinary Service; management of ICT on animal health; management of official equine health programs. Their suggestions, which were mainly related to the length of the questionnaire and the number of alternatives in sociodemographic questions, were properly addressed in the development of the final version of the closed questionnaire.

The closed questionnaire applied in the quantitative phase covered the following aspects: 1) Sociodemographic and ICT familiarity, with questions of multiple choice and selection lists; 2) Dichotomous questions (Y/N) about the awareness of the existence of e-government related to animal health in RS; 3) Availability of resources, computer self-efficacy and perceived compatibility with lifestyle, evaluated using a seven-point Likert scale, where 1= strongly disagree and 7= completely agree; and 4) Declared intention to adopt e-GTA, assessed through a seven-point Likert scale as described above.

The enunciation presented for the aspect 3) described above assumed that respondents had little or no knowledge about e-GTA, considering that this study focused on adoption intention and so

did not consider those who had already adopted the system. Thus, the following text was presented as a reference for the requested responses:

"The electronic GTA (e-GTA) is a system offered free of charge by the SEAPDR-RS which allows producers to emit their own GTA without needing to go to the Local Veterinary Unit of SEAPDR (LVU). To use the system, the producer must register at the LVU and have a computer or mobile device with internet access and printer, so it is possible to issue GTA anywhere (your house, events, etc). After issuance, the owner will be able to travel with his animal without needing to go to the LVU attend the SEAPDR-RS Veterinary Inspection, and it is necessary to carry out the same sanitary tests required for the case of GTA carried out in the province (such as glanders, equine infectious anemia, etc.). All measures for the security of the information informed are identical to those existing when a GTA is issued in the SEAPDR-RS Province."

Finally, the target population was composed by equine breeders from the state of RS that had the following characteristics: (1) were affiliated to any association of equine breeders; (2) had an active email address; and (3) were not users of the e-GTA system. In August 2017, the questionnaire was sent to the members of five different associations of equine breeders of RS by email containing a link to access the online questionnaire. A total of 387 emails were sent, being the link available for 30 days. Ninety-two replies were received (23.7% response rate), of which 21 were excluded because incompleteness, leaving 71 valid responses (77.1% of the total received). Regarding incomplete questionnaires, 16 (76.2%) were not completed in the first block of questions, while five (23.8%) were incomplete from the second block. The resulting database was analyzed using SPSS 18® software. The full questionnaire can be requested from the author, in case of interest.

Data analysis. The analysis of the questions related to sociodemographic aspects and awareness of the existence of e-Government on animal health was based on the frequency of responses, absolute and relative, which characterized the profile of respondents and their previous knowledge about the existence of these systems. The analysis of the declared intention to adopt e-GTA was based on the mean and standard deviation.

The analysis of the questions related to the construct availability of computer resources, computer self-efficacy and perceived compatibility departure from the descriptive analysis presented in Table 2. Subsequently, the reliability of the questions of each construct was analyzed using Cronbach's alpha, as shown in Table 3. The statistical adjustment of each set of questions permitted they each of these sets were grouped into three derived variables, one for each construct and whose values correspond to the arithmetic mean of their respective set of questions. The continuity of the analyses was based on these derived variables, whose descriptive statistics are presented in Table 4. The relationship between the derived variables and the declared adoption intention was measured by multiple linear regression, shown in Table 5.

RESULTS

The sociodemographic results demonstrated that most holdings (n=71 with complete responses) had only horses (57.7%), followed by those having horses and cattle or sheep (39.4%). Most holdings had up to ten horses (63.4%) of Criollo breed (85.9%) and were dedicated to both sports or leisure in general (69.7%). Regarding the owners, the majority had academic

degrees not related to agricultural areas (77.5%). They were affiliated to at least one organization of horse owners (85.9%), and had veterinary assistance only for emergencies (69.1%). Regarding animal movement, most holdings issued up to four GTA monthly (80.6%), and to move up to four horses per GTA (80.2%). None of the respondents used e-GTA and, when needed issued them either directly at SEAPDR-RS offices (88.7%) or by an accredited private veterinarian (11.3%).

Regarding awareness of the existence of e-Government on animal health, most respondents (59.1%) had heard about the SEAPDR website, and 33.8% of them had already accessed it, while a minority parcel (21.1%) had heard about e-GTA.

The descriptive analysis of the declared intention to adopt e-GTA resulted in a mean (SD) of 4.56 (1.30), indicating that respondents had a positive trend to adopt this system.

Table 2. Results of the descriptive statistics of the questions related to the constructs availability of computer resources, computer self-efficacy and perceived compatibility

Question	Construct	Mean	Standard deviation
Quality computer internet connection	Availability of resources	4.58	1.46
Quality of computer	Availability of resources	5.33	0.89
Quality cellphone internet connection	Availability of resources	3.72	0.81
Quality of cellphone	Availability of resources	5.83	0.77
Computer/mobile self-efficacy	Computer self-efficacy	5.44	1.08
Internet self-efficacy	Computer self-efficacy	5.81	0.92
e-government use self-efficacy	Computer self-efficacy	4.86	0.86
Friendliness of E-GTA website	Perceived compatibility	3.22	1.07
Usefulness of e-GTA	Perceived compatibility	5.00	0.79
e-GTA *vs* lifestyle	Perceived compatibility	5.25	1.02

Table 3. Cronbach's alpha values of the questions of the constructs availability of computer resources, computer self-efficacy and perceived compatibility

Question	Construct		
	Availability of resources	Computer self-efficacy	Perceived compatibility
Quality computer internet connection	0.80		
Quality of computer	0.48		
Quality cellphone internet connection	0.48		
Quality of cellphone	0.45		
Computer/mobile self-efficacy		0.79	
Internet self-efficacy		0.69	
e-government use self-efficacy		0.77	
Friendliness of E-GTA website			0.47
Usefulness of e-GTA			0.40
e-GTA *vs* lifestyle			0.66
Cronbach's alpha	0.71	0.87	0.62

Table 4. Descriptive statistics of the variables derived from the constructs availability of computer resources, computer self-efficacy and perceived compatibility

Derived variable (construct)	Mean	Standard deviation
Availability of resources	4.86	0.75
Computer self-efficacy	5.37	0.86
Perceived compatibility	4.49	0.73

Table 5. Results of multiple linear regression having as dependent variable Y = declared adoption intention and independent variables X1 = availability of resources, X2 = computer self-efficacy and X3 = perceived compatibility

Derived variable (construct)	Coeficients		Standardized coeficients		
	B	Standard error	Beta	T	Sig.
(Constant)	0.066	1.509		0.043	
Availability of resources	-0.195	0.183	-0.113	-1.064	0.295
Computer self-efficacy	-0.225	0.170	-0.149	-1.328	0.194
Perceived compatibility	1.480	0.195	0.836	7.609	0.001

The analysis of dependent variables indicated that respondents positively evaluated the quality of their computers and cellphones, as well as their efficacy to operate them. Conversely, the quality of the internet connection of both computers and cellphone was considered regular. Regarding compatibility with lifestyle, most respondents considered the usefulness of e-GTA positively, while there is a trend to consider the friendliness of the system negatively.

Regarding the validation of the proposed hypothesis, the variable perceived compatibility presented a significance level of $p=<0.05$. Thus, based on the result obtained:

Hypothesis 1 was rejected: the availability of computer resources positively influences the declared intention to adopt e-GTA;

Hypothesis 2 was rejected: Computer self-efficacy positively influences the declared intention to adopt e-GTA;

Hypothesis 3 was validated: The perceived compatibility of e-government on animal health with lifestyle positively influences the declared intention to adopt e-GTA.

DISCUSSION

The present study aimed to explore factors that could influence the intention to adopt e-government on animal health in RS state, for which the object of research was the e-GTA in RS. Theoretical background were researches on the adoption of ICT, including seminal studies that provided the basis of current knowledge on the subject. Among these, GAM had a central role, from which the study dimension and its respective constructs were defined.

Initially, it should be noted that this is an exploratory study, and thus presents some intrinsic limitations, derived from the lack of previous studies directed to e-government on animal health public policies, and as inferential limitations arising from the sampling process. In addition, the percentage of abandonment of the questionnaire on the first and second blocks of questions (22.9%) may suggest the need to review the extension of the survey instrument.

It could be suggested future research to consider the use of multiple questionnaire delivery routes, including making them available on physical format for segments of the population not reached by electronic means. This suggestion is in line with an emerging concern in e-government research, the "digital divide" (Lin et al. 2011, Savoldelli et al. 2014, Seo & Bernsen 2016, Abu-Shanab 2017, Okunola et al. 2017), which is related to the access of rural or low-income populations to these services, and which has the been object of research, especially in developing countries.

In assessing the relationship between the three considered constructs and the declared intention to adopt e-GTA, there was a significant association between the latter and the construct "perceived compatibility". This result is in line with the theoretical foundation of the subject, considering that this construct is derived from other constructs such as perceived utility, perceived ease of use, relative advantage and expected performance, which, if verified as positive by the users, generally are positively related to adoption intention (Davis 1989, Davis et al. 1989, Delone & Mclean 1992, Chau & Hu 2001, Venkatesh et al. 2003, Carter & Bélanger 2005, Anthopoulos et al. 2007, Shareef et al. 2007, Wang & Liao 2008, Lallmahomed et al. 2011, Shareef et al. 2011, Al-Hujran et al. 2015, Kumar et al. 2018).

Regarding the awareness of e-Government and intention to adopt these systems, the present study suggested the opportunity for further studies, as while the majority of the respondents had not heard about e-GTA, most of them expressed an intention to adopt it after being presented to the enunciation containing a brief description of this system. is also aligned with reference literature, which even warns that the attention of e-government development has been excessively directed towards structural development of systems in detriment of information campaigns and digital inclusion actions (Lin et al. 2011, Weerakkody et al. 2013, Savoldelli et al. 2014, Seo & Bernsen 2016, Abu-Shanab 2017, Krishnan et al. 2017, Das et al. 2017, Okunola et al. 2017). In the present study, the fact that the majority of respondents had heard about the existence of the e-GTA, while most had not heard about the SEAPDR website, may indicate that the need of GTA is known, although the connection between the latter and its competent authority remains unclear for the users. Moreover, it may indicate that adoption campaigns could bring positive results, although further studies covering a broader spectrum of livestock producers could be necessary. Additionally, digital inclusion may enable the effective implementation of public participation on systems relevant to animal health policies, such as disease reporting systems, area on which the Brazilian government has already implemented innovative initiatives as the Brazilian Veterinary Surveillance and Emergency System - e-Sisbravet (MAPA 2020). In this context, it is important to consider the relevancy of macrostructural elements on the progress of e-government adoption. In the present study, quality of the internet connection was considered by respondents as regular, having the lowest score amongst the questions related to availability of resources, and may represent a limitation for the adoption and use of e-government. Similar consideration could also be applied to the evaluation of the friendliness of the system, as it was essentially based upon third party information rather than personal experience and may represent a message to competent authorities regarding public perception of e-government systems.

On the other hand, there was no association between the intention to adopt e-GTA and the constructs availability of resources and computer self-efficacy, which coincides with the revised literature (Kumar et al. 2007, Van Dijk et al. 2008, Shareef et al. 2011, Lallmahomed et al. 2011). It can be argued that this finding is possibly related to the fact that both constructs may refer to pre-existing capabilities rather than in attention to any specific need for e-government, which was already adopted by users to perform other activities of their interest, such as internet browsing and miscellaneous computer operations. Further studies may be necessary to appropriately investigate the relationship between these constructs and perception regarding the system, i.e., how the user's installed structural and operational capacities influence perceptions on friendliness.

Additionally, it is worth considering that the evaluation of the quality of the internet connection was unfavorable for most respondents. This aspect was an important limiting factor regarding both the adoption and continuous use of e-government (Rey-Moreno et al. 2018). It is important to consider that the quality of internet connection was embedded in a macro-environment of public infrastructure policies, and

thus the limitations found in the present study may reach multiple areas of internet-dependent e-government.

Finally, there is an opportunity for further studies on e-GTA directed to other sectors of animal production, as well as studies verifying factors influencing the continuity of use after adoption.

CONCLUSIONS

The use of e-government for animal health policies in Brazil was on early stages and presented opportunities for expansion, which was the case of e-GTA, considering both its limited current use and the clear interest of equine breeders to adopt these systems. Therefore, the use of communication strategies could contribute both in terms of the initial presentation of the systems and on what concerns the proper training of users.

The increase of the use of this system could optimize delivering of public services, as well as the possibility of developing other systems on animal health that could contribute to the implementation of public policies in this area, including those related to notification of diseases.

Moreover, the findings on the poor quality of internet connection could support public administration on the decision to implement policies aiming to improve the quality of internet services in Brazil.

Finally, the contribution of this article to the understanding of e-government adoption in Brazil, especially the ones focusing on animal health policies, was a relevant achievement, given the scarcity of researches in this area.

Conflict of interest statement.- The authors declare no conflicts of interest.

REFERENCES

Abu-Shanab E.A. 2017. E-government familiarity influence on Jordanians' perceptions. Telematics Informatics 34(1):103-113. <http://dx.doi.org/10.1016/j.tele.2016.05.001>

Alcaide-Muñoz M.L., Rodríguez–Bolívara M.P., Cobob M.J. & Herrera–Viedma E. 2017. Analysing the scientific evolution of e-government using a science mapping approach. Government Information Quarterly 34(3):545-555. <http://dx.doi.org/10.1016/j.giq.2017.05.002>

Al-Hujran O., Al-Debei M.M., Chatfield A. & Migdadi M. 2015. The imperative of influencing citizen attitude toward e-government adoption and use. Computers Human Behavior 53:189-203. <http://dx.doi.org/10.1016/j.chb.2015.06.025>

Al-Jabri I.M. & Roztocki N. 2014. Adoption of ERP systems: does information transparency matter? Telematics Informatics 32(2):300-310. <http://dx.doi.org/10.1016/j.tele.2014.09.005>

Anthopoulos L.G., Siozos P. & Tsoukalas L.A. 2007. Applying participatory design and collaboration in digital public services for discovering and re-designing e-government services. Government Information Quarterly 24(2):353-376. <http://dx.doi.org/10.1016/j.giq.2006.07.018>

Brazil 2017. Histórico do Programa de Governo Eletrônico Brasileiro. Available at <https://www.governoeletronico.gov.br/sobre-o-programa/historico> Accessed on August 13, 2019.

Brazil 2019. Portal de Serviços. Available at <https://www.gov.br/pt-br/> Accessed on September 12, 2019.

Carter L. & Bélanger F. 2005. The utilization of e-government services: citizen trust, innovation and acceptance factors. Information Systems J. 15(1):5-25. <http://dx.doi.org/10.1111/j.1365-2575.2005.00183.x>

Chahin A., Cunha M.A., Knight P.T. & Pinto S.L. 2004. E-gov.br: a próxima revolução brasileira. Prentice Hall, São Paulo, p.94-117.

Chau P.Y.K. & Hu P.J.H. 2001. Information technology acceptance by individual professionals: a model comparison approach. Decision Sci. 32(4):699-719. <http://dx.doi.org/10.1111/j.1540-5915.2001.tb00978.x>

Das A., Singh H. & Joseph D. 2017. A longitudinal study of e-government maturity. Information Manag. 54(4):415-426. <http://dx.doi.org/10.1016/j.im.2016.09.006>

Davis F. 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly 13(3):319-340. <http://dx.doi.org/10.2307/249008>

Davis F., Bagozzi R. & Warshaw P. 1989. User acceptance of computer technology: a comparison of two theoretical models. Manag. Sci. 35(8):982-1003. <http://dx.doi.org/10.1287/mnsc.35.8.982>

De Róiste M. 2013. Bringing in the users: the role for usability evaluation in e-government. Government Information Quarterly 30(4):441-449. <http://dx.doi.org/10.1016/j.giq.2013.05.007>

Delone W.H. & Mclean E.R. 1992. Information systems success: the quest for the dependent variable. Information Systems Res. 3(1):60-95. <http://dx.doi.org/10.1287/isre.3.1.60>

FAO 2012. Law and Sustainable Development since Rio - Legal Trends in Agriculture and Natural Resource Management. FAO Legal Office, Food and Agriculture Organization of the United Nations, Roma, p.53-56.

Fèvre E.M., Bronsvoort B.M. C., Hamilton K.A. & Cleaveland S. 2006. Animal movements and the spread of infectious diseases. Trends Microbiol. 14(3):125-131. <http://dx.doi.org/10.1016/j.tim.2006.01.004> <PMid:16460942>

Goodhue D.L. & Thompson R.L. 1995. Task-technology fit and individual performance. MIS Quarterly 9(2):213-236. <http://dx.doi.org/10.2307/249689>

IAGRO 2018. Sistema e-Saniagro disponibiliza controle para a sanidade animal de padrão nacional e novos serviços aos produtores rurais de MS. Available at <http://www.iagro.ms.gov.br/tag/saniagro/> Accessed on November 20, 2018.

Krishnan S., Teo T.S.H. & Lymm J. 2017. Determinants of electronic participation and electronic government maturity: Insights from cross-country data. Int. J. Information Manag. 37(4):297-312. <http://dx.doi.org/10.1016/j.ijinfomgt.2017.03.002>

Kumar R., Sachan A. & Mukherjee A. 2017. Qualitative approach to determine user experience of e-government services. Computers Human Behavior 71:299-306. <http://dx.doi.org/10.1016/j.chb.2017.02.023>

Kumar R., Sachan A. & Mukherjee A. 2018. Factors influencing e-government adoption in India: a qualitative approach. Digital Policy, Regulation Governance 20(5):413-433. <http://dx.doi.org/10.1108/DPRG-02-2018-0007>

Kumar V., Mukerji B., Butt I. & Persaud A. 2007. Factors for successful e-government adoption: a conceptual framework. Electron. J. e-government 5(1):63-76.

Laia M.N., Cunha M.A.A.V.C., Nogueira A.C.R. & Mazzon J.A. 2011. Electronic government policies in Brazil: context, ICT management and outcomes. Rev. Adm. Empr. 51(1):43-57. <http://dx.doi.org/10.1590/S0034-75902011000100005>

Lallmahomed M.Z.I., Lallmahomed N. & Lallmahomed G.M. 2017. Factors influencing the adoption of e-government services in Mauritius. Telematics Informatics 34(4):57-72. <http://dx.doi.org/10.1016/j.tele.2017.01.003>

Lallmahomed M.Z.I., Rahim N.Z.A., Ibrahim R. &, Rahman A.A. 2011. A preliminary classification of usage measures in information system acceptance: a Q-sort approach. Int. J. Technol. Diffus., v.2(4):25-47. <http://dx.doi.org/10.4018/jtd.2011100103>

Lin F., Fofanah S.S. & Liang D. 2011. Assessing citizen adoption of e-government initiatives in Gambia: a validation of the technology acceptance model in

information systems success. Government Information Quarterly 28(2):271-279. <http://dx.doi.org/10.1016/j.giq.2010.09.004>

Ma L. & Zheng Y. 2018. Does e-government performance actually boost citizen use? Evidence from European countries. Public. Management. Review. 20(10):1513-1532. <http://dx.doi.org< https://doi.org/10.1080/14719037.2017.1412117>

Mansley L.M., Dunlop P.J., Whiteside S.M. & Smith R.G.H. 2003. Early dissemination of foot-and-mouth disease virus through sheep marketing in February 2001. Vet. Rec. 153(2):43-50. <http://dx.doi.org/10.1136/vr.153.2.43> <PMid:12885212>

MAPA 1934. Decreto nº 24.548 de 3 de julho de 1934. Ministério da Agricultura, Pecuária e Abastecimento, Brasília, DF. Available at <http://www.planalto.gov.br/ccivil_03/decreto/1930-1949/D24548.htm> Accessed on September 28, 2019.

MAPA 1977. Portaria DDSA nº 51, de 19 de dezembro de 1977. Available at <http://www.cidasc.sc.gov.br/defesasanitariaanimal/files/2013/03/PORTARIA-N%C2%BA-51-1977-MAPA.pdf> Accessed on September 12, 2018.

MAPA 1986. Portaria DDSA nº 02, de 19 de fevereiro de 1986. Available at <http://www.cidasc.sc.gov.br/defesasanitariaanimal/files/2013/03/PORTARIA-N%C2%BA-51-1986-MAPA.pdf> Accessed on October 13, 2019.

MAPA 1995. Portaria DDSA nº 22, de 13 de janeiro de 1995. Available at <http://extranet.agricultura.gov.br/sislegis-consulta/consultarLegislacao.do?operacao=visualizar&id=2300> Accessed on September 28, 2019.

MAPA 2011. Instrução Normativa MAPA nº 19, de 3 de maio de 2011. Available at <https://www.defesa.agricultura.sp.gov.br/legislacoes/instrucao-normativa-mapa-19-de-03-05-2011,1000.html> Accessed on September 28, 2019.

MAPA 2020. Sistema Brasileiro de Vigilância e Emergências Veterinárias (e-SISBRAVET). Available at <http://sistemasweb.agricultura.gov.br/pages/SISBRAVET.html> Accessed on March 1, 2020.

Mensah I.K. & Mi J. 2019. Computer self-efficacy and e-government service adoption: the moderating role of age as a demographic factor. Int. J. Public Administration 42(2):158-167. <http://dx.doi.org/10.1080/01900692.2017.1405980>

OIE 2017. History of the OIE. Available at <http://www.oie.int/about-us/history> Accessed on July 16, 2019.

Okunola O.M., Rowley J. & Johnson F. 2017. The multi-dimensional digital divide: perspectives from an e-government portal in Nigeria. Government Information Quarterly 34(2):329-339. <http://dx.doi.org/10.1016/j.giq.2017.02.002>

Ozkan S. & Kanat I.E. 2011. E-Government adoption model based on theory of planned behavior: empirical validation. Government Information Quarterly 28(4):503-513. <http://dx.doi.org/10.1016/j.giq.2010.10.007>

Rey-Moreno M., Felício J.A., Medina-Molina C. & Rufín R. 2018. Facilitator and inhibitor factors: adopting e-government in a dual model. J. Business Res. 88:542-549. <http://dx.doi.org/10.1016/j.jbusres.2017.11.015>

Rogers, E.M. 2003. Diffusion of Innovations. 5th ed. The Free Press, New York, p.47-69.

Santos D.V., Silva G.S., Weber E.J., Hasenack H., Groff F.H.S., Todeschini B., Borba M.R., Medeiros A.A.R., Leotti V.B., Canal C.W. & Corbellini L.G. 2017. Identification of foot and mouth disease risk areas using a multi-criteria analysis approach. PLoS One 12(5):e0178464. <http://dx.doi.org/10.1371/journal.pone.0178464> <PMid:28552973>

Savoldelli A., Codagnone C. & Misuraca G. 2014. Understanding the e-government paradox: learning from literature and practice on barriers to adoption. Government Information Quarterly 31(supl.1):S63-S71. <http://dx.doi.org/10.1016/j.giq.2014.01.008>

SEAPDR-RS 2019. SDA - Sistema de Defesa Agropecuária. Available at <http://www.agricultura.rs.gov.br/sda.> Accessed on March 21, 2019.

Seo D.B. & Bernsen M. 2016. Comparing attitudes toward e-government of non-users versus users in a rural and urban municipality. Government Information Quarterly 33(2):270-282. <http://dx.doi.org/10.1016/j.giq.2016.02.002>

Shareef M. A., Kumar U., & Kumar V. 2007. Developing fundamental capabilities for successful e-government implementation. Proceedings of ASAC Conference, Ottawa, p.159-177.

Shareef M.A., Kumar V., Kumar U. & Dwivedi Y.K. 2009. Identifying critical factors for adoption of e-government. Electron. Government, Int. J. 6(1):70-96. <http://dx.doi.org/10.1504/EG.2009.022594>

Shareef M.A., Kumar V., Kumar U. & Dwivedi Y.K. 2011. e-government Adoption Model (GAM): differing service maturity levels. Government Information Quarterly 28(1):17-35. <http://dx.doi.org/10.1016/j.giq.2010.05.006>

Tashakkori A. & Teddlie C. 1998. Mixed Methodology: combining qualitative and quantitative approaches. Sage Publications Inc, Thousand Oaks, p.59-111.

Teddlie, C. & Tashakkori A. 2006. A general typology of research designs featuring mixed methods. Res. Schools 13(1):12-28.

Todeschini B., Costa E.F., Santiago-Neto W., Santos D.V., Groff A.C.M., Borba M.R. & Corbellini L.G. 2018. Ocorrência de brucelose e tuberculose bovinas no Rio Grande do Sul com base em dados secundários. Pesq. Vet. Bras. 38(1):15-22. <http://dx.doi.org/10.1590/1678-5150-pvb-4712>

Tursunbayeva A., Franco M. & Pagliari C. 2017. Use of social media for e-government in the public health sector: a systematic review of published studies. Government Information Quarterly 34(2):270-282. <http://dx.doi.org/10.1016/j.giq.2017.04.001>

United Nations 2016. E-Government Survey 2016. Available at <http://workspace.unpan.org/sites/Internet/Documents/UNPAN97453.pdf>. Accessed on July. 14, 2017.

USDA 2014. Foot and Mouth Disease Response Plan: the red book. Available at <https://www.aphis.usda.gov/animal_health/emergency_management/downloads/fmd_responseplan.pdf> Accessed on July 1, 2019.

Van Dijk J.A.G.M., Peters O. & Ebbers W. 2008. Explaining the acceptance and use of government internet services: a multivariate analysis of 2006 survey data in the Netherlands. Government Information Quarterly 25(3):379-399. <http://dx.doi.org/10.1016/j.giq.2007.09.006>

Venkatesh V., Morris M.G., Davis G.B. & Davis F.D. 2003. User acceptance of information technology: toward a unified view. MIS Quarterly 27(3):425-478. <http://dx.doi.org/10.2307/30036540>

Vergara E. 2017. Personal communication (SEAPDR-RS, Brazil).

Verkijika S.F. & De Wet L. 2018. E-government adoption in sub-Saharan Africa. Electron. Commerce Res. Applications 30:83-93. <http://dx.doi.org/10.1016/j.elerap.2018.05.012>

Wang Y.S. & Liao Y.W. 2008. Assessing e-government systems success: a validation of the Delone and Mclean model of information systems success. Government Information Quarterly 25(4):717-733. <http://dx.doi.org/10.1016/j.giq.2007.06.002>

Weerakkody V., El-Haddadeh R., Al-Sobhi F., Shareef M.A. & Dwivedi Y.K. 2013. Examining the influence of intermediaries in facilitating e-government adoption: an empirical investigation. Int. J. Information Manag. 33(5):716-725. <http://dx.doi.org/10.1016/j.ijinfomgt.2013.05.001>

Woodford M. H. 1993. International disease implications for wildlife translocation. J. Zoo Wildl. Med. 24(3):265-270.

World Bank 2017. e-Gov Research and Resources. Available at <http://www.worldbank.org/en/topic/ict/brief/e-gov-resources#egov> Accessed on July 15, 2018.

Zhigang L. & Fengyue Y. 2016. The e-government information model based on GPR. Procedia Computer Sci. 91:193-200. <http://dx.doi.org/10.1016/j.procs.2016.07.057>