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ARTIGO – TECNOLOGIA DA INFORMAÇÃO

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ABSTRACT

The purpose of this paper is to explore the secondary data (microdata) from Brazilian “ICT in households and enterprises Survey” in order to understand how the individuals’ use of electronic government services (e-gov) is affected by their location of access to the internet and usage competences of Brazilian internet users. To this end, this research was based on the approach of the capabilities developed by economist Amartya Sen. The procedures concerning processing and data analysis were based on the application of descriptive (univariate and bivariate analysis of frequency) and multivariate statistical techniques (binary logistic regression). The results indicate that the use of e-government services is closely related to the following skills: e-mail usage, e-commerce (search for goods and services) and financial services (consultations). Such skills are favored by Internet access at home and at work, preferred routes to other alternatives such as Internet cafes (public centers providing free access) and tele-centers (public centers with free access). Finally, the article discusses the potential implications of the results of this research in the development of public policies for digital inclusion.

Key words: E-Government, Capability Approach, Digital Inclusion, Tele-centers.

FATORES QUE INFLUENCIAM O USO DE SERVIÇOS DE GOVERNO ELETRÔNICO NO BRASIL

RESUMO

O presente artigo tem como objetivo explorar os dados secundários (microdados) da pesquisa TIC Domicílios, a fim de compreender como o uso de serviços de governo eletrônico é influenciado pelos diferentes locais de acesso à internet e pelas competências de uso dos internautas brasileiros. Para tanto, esta investigação fundamentou-se na abordagem das Capacidades desenvolvida pelo economista Amartya Sen. Os procedimentos referentes ao tratamento e análise de dados basearam-se na aplicação de técnicas estatísticas descritivas (análise de frequência univariada e bivariada) e multivariada (regressão logística binária). Os resultados indicam que o uso dos serviços de governo eletrônico está fortemente relacionado às seguintes competências: uso do e-mail, e-commerce (busca de produtos e serviços) e serviços financeiros (consultas). Tais competências são favorecidas pelo acesso à internet em casa e no trabalho, vias preferidas às demais alternativas de acesso, como as *lan-houses* (centros públicos de acesso pago) e os telecentros

(centros públicos de acceso gratuito). Por fim, o artigo discute as potenciais implicações dos resultados desta investigação no desenvolvimento de políticas públicas de inclusão digital.

Palavras-chave: Governo Eletrônico, Abordagem das Capacidades, Inclusão Digital, Telecentros.

FACTORES QUE INFLUENCIAN EL USO DE SERVICIOS DE GOBIERNO ELECTRÓNICO EN BRASIL

RESUMEN

El presente artículo tiene el objetivo de explotar los datos secundarios (micro datos) de la investigación TIC Domicilios, con la finalidad de comprender cómo el uso de servicios de gobierno electrónico es influenciado por los diferentes locales de acceso a Internet y por las competencias de uso de los usuarios brasileños de Internet. Para tanto, esta investigación se fundamentó en el abordaje de las Capacidades desarrollado por el economista Amartya Sen. Los procedimientos referentes al tratamiento y análisis de datos se basaron en la aplicación de técnicas estadísticas descriptivas (análisis de frecuencia univariado y bivariado) y multivariado (regresión logística binaria). Los resultados indican que el uso de los servicios de gobierno electrónico está fuertemente relacionado a las siguientes competencias: uso del e-mail, e-commerce (busca de productos y servicios) y servicios financieros (consultas). Tales competencias son favorecidas por el acceso a Internet en casa y en el trabajo, vías preferidas a las demás alternativas de acceso, como los locutorios / lan-houses (centros públicos de acceso gratuito) y los tele centros (centros públicos de acceso gratuito). Finalmente, el artículo discute las potenciales implicaciones de los resultados de esta investigación en el desarrollo de políticas públicas de inclusión digital.

Palabras-clave: Gobierno Electrónico, Abordaje de las Capacidades, Inclusión Digital, Tele centros.

1. INTRODUCTION

The development of the Information Society includes the risk of creating a new form of social exclusion: that of individuals deprived of digital resources. Although digital inclusion has been widely studied (WILHELM, 2000; CASTELLS, 2001; 2010; SORJ; GUEDES, 2005; MORI; ASSUMPÇÃO, 2007; MADON et al., 2009) it cannot be reduced to providing physical access to the technological resources, but must consider user diversity and ability for the different uses (entertainment, communication, education, e-commerce, e-government, etc.).

The Brazilian Internet Steering Committee (CGI.br, in Portuguese) and other international institutions (UNO, OECD, World Bank and others) have developed indicators and metrics of the appropriation of ICTs, in order to understand the multiple dimensions of digital inclusion.

Since 2005 CGI has sponsored a yearly large nationwide survey of the access and use of ICT in households and enterprises. CGI.br designed its survey in accordance with OECD, Eurostat and Partnership on Measuring ICT for Development methodology, thus allowing international comparisons (CGI, 2012). The survey statistics and methodology are available in Portuguese and English in <http://www.cgi.br/publicacoes/index.htm>.

The access to the survey's microdata allows the in-depth analysis of different aspects of internet users' behavior. For the present paper, the research question chosen is: How is the individuals' adoption and use of e-government services related to their preferred location of access to the internet and their usage capabilities?

Answers to these questions should help in evaluating the effectiveness of (usually very high cost of nation-wide) public policies related to promoting the provision of internet access in public locations or at home and the need for user information and training. In fact, many of the once ubiquitous lan-houses (estimated at 108,000 in 2009) are going out of business despite government support, while the demand falls for the about 20,000 public telecenters (ABCID, 2013; CGI, 2012).

The results of this research should contribute to an improved understanding of the factors that influence the usage of e-gov services, in order to orient the definition of public policies for digital inclusion (in this case, the usage of e-gov services).

The paper is organized as follows: section 2 presents a brief literature review and the research reference model. Section 3 describes the research design and the methodology employed. Data Analysis and discussions, contributions are contained in section 4; final considerations are presented in section 5.

2. LITERATURE REVIEW

2.1. Digital Inclusion

Digital Exclusion is a major theme of Information Society research, dealing with the social, economic and cultural consequences of the unequal distribution of access to computers and the internet, thus Digital Exclusion is one facets of social exclusion (BROADBENT; PAPADOPOULOS, 2013). There is the recognition that public policies are needed to overcome these problems through the dissemination of digital technology, such as the Brazilian Information Society Program (TAKAHASHI, 2000), also aiming at improving citizens' access to government services and democratic participation.

Restricting the problem to the dichotomy between "having" or "not having" access to computers and the internet is an oversimplification. In fact, research focusing only on citizens' access to technological artifacts, according to (AVGEROU, 2003) has a "technological determinism bias".

This indicates that digital exclusion is a complex issue, requiring considering other dimensions beyond the dichotomy of included and excluded individuals (SORJ; GUEDES, 2005).

In this line, the present paper will not focus on the access to digital resources, but on its qualified use, focusing on the factors contributing to the use of e-government services. Although E-government may have different definitions, our research considers the use of internet to improve the provision of government services to citizens, information and democratic participation.

2.2 Electronic Government Services

Governments have made extensive use of these technological resources in order to increase its offer of services to citizens and also improving their effectiveness and quality. These systems, based on the use of Information and Communication Technologies, and, in particular, the subsystems that provide the interface with citizens, are studied under the generic name of electronic government, or, in short, e-gov (DINIZ et al., 2009; SANTOS; REINHARD, 2011).

Electronic Government as a research area, besides studying the use of Information and Communication Technologies (ICT) for the interaction between citizens and private organizations with public administration (the so-called “front office”, does also include the “back office”: automation and integration of the different public administration processes and interorganizational systems communication. Haldenwang (2004:418) understand e-gov as the strategic and co-ordinated use of Information and Communication Technologies (ICT) in the public administration and political decision making.

Although the most visible dimension of electronic government relates to the provision of government services in electronic form, there are also other applications that studied under the name of e-gov.

The popularization and positive image of these electronic services, such as the citizen's electronic filing of Income Tax Adjustments (REINHARD; MOYA, 2002) and electronic voting system (AVGEROU et al., 2009) have led to equate electronic government with electronic citizen-facing service provision in current language. However Diniz et al. (2009) point out that the field has to be expanded to include also other application of the technology in Government activities.

One classification, used for several authors such as by Cunha and Miranda (2008) and also Barbosa, Pozzebon and Diniz (2013) and Haldenwang (2007), identifies three major categories of e-gov applications:

- **Public Management applications:** the use of ICT to improve the management of government

activities, administrative processes and resource usage and also the formulation, implementation, monitoring and control of public policies.

- **E-services:** the use of ICT for the communication with and the provision of services in electronic form to citizens and private organizations.

- **E-democracy:** the use of ICT resources in order to allow citizens to become better informed about government and facilitate their increasing participation in forming public opinion and in decision making processes.

2.3. Amartya Sen's Capability Approach

Amartya Sen proposed the Capability Approach as a reference for the human development paradigm (SEN, 2001; REINHARD, 2010) having been used as a basis for several development indicators, such as the Human Development Index and the ICT Development Index (ITU, 2011).

The Capability Approach offers an objective basis for comparisons of differences of well-being between individuals (PRENDERGAST, 2005), thus overcoming the limitations of utilitarian approaches that do not allow this comparison, basic for well-being economics.

For the Capability Approach, the properties or characteristics of goods or resources have to be seen in terms “what they do to human beings”. By taking possession of an object (a commodity), the owner is able to “command” these characteristics. However, (SEN, 2001) cautions that these characteristics do not inform in advance how these goods will be utilized. Therefore, the possession of a good will not necessarily result in an increase in the person's well-being because its use cannot be determined beforehand. The change will only be in the possibilities of achievements a person can obtain from these characteristics.

Therefore, Sen (2001) argues that the well-being of a person should consider its “functionings”, that is, “what the person succeeds in doing with the commodities and characteristics at his or her command” (SEN, 1999:6).

The achieved functioning will depend both on the possessed resource and on the way this resource is used. Thus, they have the freedom to choose among different functionings. This set of

functionings persons can achieve is called their Capabilities.

According to Sen (2001), the process of conversion of the goods' characteristics into functionings depends on many factors, personal, cultural and social, that are called "conversion factors". Different persons having access to the same resources can end up with quite different functionings.

3. RESEARCH REFERENCE MODEL AND METHODOLOGY

There are multiple approaches to the study of technological innovations adoption and use such as e-gov services by citizens. One major line of research is based on the use of the Technological Acceptance Model (TAM) (DAVIS, 1989) and related models, such as TAM 2 (VENKATESH; DAVIS, 2000); UTAUT (VENKATESH et al., 2003).

These models consider the perception of potential users regarding the usefulness, ease of use and other attributes of the technology, in

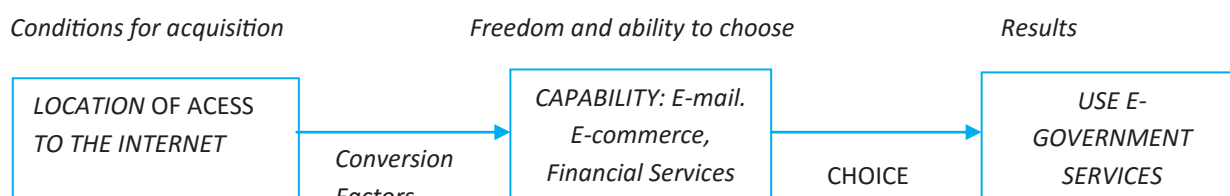
order to predict the users' attitude toward using the technology.

The present study is based on secondary data that measure the effective use of egov services, instead of just the users' attitude (leading to the future decision to eventually use the services) and therefore going one step further than those models. These models also do not consider explicitly individual user preferences that are not related to the model variables and therefore their freedom to possibly choose not to use the services, despite favorable conditions identified by the models.

The Capability Approach, presented in section 2.3, has therefore, some advantages over those models for our study, as it allows considering effective user actions instead of just perceptions, and including the dimension of freedom and ability to choose among alternatives.

Figure 1 is a schematic representation focusing on the specific variables of the paper's reference model.

Figure 1 – Reference Model



Source: Adapted from Robeyns (2005:98) and Reinhard (2010).

As research propositions we then present the following reasoning: Starting with the comparison of preferred location of internet access and its influence on the user's capabilities (conversion factor), for which we propose as proxies the actual use of e-mail, e-commerce (search function) and e-financial services (checking banking accounts).

The "use of email", as one of the main electronic communication tools was used as one of the proxy variables, because it is understood that this is a basic electronic communication competence, being also a requirement for the use of some e-gov services (e.g. filling police report). The inclusion of the "use of e-commerce" variable is based on arguments presented by

Diniz et al. (2009) for whom the offer of e-government services began to grow in Brazil with the diffusion of e-commerce usage, thus supporting the assumption that the use of e-commerce competence contributes to the use of e-gov. Finally, "financial services" is proposed as another proxy variable for competence due to both its similarity with and its direct use in e-gov services (e.g. paying taxes)

It should be noted that the choice of e-commerce and financial services variables are restricted to consulting (searching) activities, since some users may not possess credit cards or other necessary tools, or have other reasons not to carry out the complete transaction, despite their competence to interact with the system.

These capabilities mediate the user ability to choose the functionalities (in this case the decision to use or not to use e-gov services). All conversion factors and subsequent choices are analyzed as mediated by social class and preferred location to access the internet.

The actual use of e-mail, e-commerce (search function) and financial services (checking banking accounts) are basic and frequent activities of internet users and bear some similarity with the competences needed to use e-gov services. We posit that these uses, being performed with higher frequency, indicate users' capabilities that

function as enabling factors to the not so frequent use of e-gov services. Table 1 describes the variables analyzed in this paper.

The Capability Approach provides an appropriate framework to explore this chain of enabling factors evidenced by users' choices (preferred location for Internet Access) and actions (use of resources), variables that are measured objectively in the survey. In this research we use the data presented in Table 1 from the microdata of the above mentioned CGI survey for the years 2007, 2009 and 2011.

Table 1 – Variables

Variable	Categories
Social Class	A and B (combined), C, D and E (combined)
Preferred Location for Internet Access	Home; Work; School; Other person's home; Lan House; Free Public Telecenter;
Use of Electronic Government	Yes/No
Use of E-mail	Yes/No
Use of E-commerce (search for products and prices)	Yes/No
Use of Financial Services (checking banking accounts)	Yes/No

Source: Research data.

The data refer to the respondents' demographic data, their access to ICT resources and usage characteristics (use of e-mail, financial services, e-commerce and e-government services). The sample considers respondents over 15 years of

age, residing in urban areas that have used the internet during the last three months (See Table 2). The survey, based on statistically valid samples, is representative of the Brazilian population, with the following sample sizes.

Table 2 – The survey household segment sample size for urban respondents over age 15

	2007	2009	2011
Respondents – Total	5638	7158	8661
Class AB (combined)	2231	2992	4099
Class C	2751	3556	4022
Class DE (combined)	656	610	540
E-gov users	4046	4964	5879
E-mail users	4599	5969	7203
E-commerce (search for products and prices)	3244	4661	6143
Financial Services (checking banking accounts)	1051	1256	2491

Source: Research data.

The research uses the following selection of variables from the CGI survey: (1) Demographic variables: age, economic data, access to computers and internet, preferred location for internet access; (2) Social Class constructed by CGI from the respondents' demographic data, as defined by the Brazilian Census Bureau's (IBGE) methodology.

The present inquiry is restricted to the analysis of Social Classes C and DE, where digital inclusion issues and related public policies are seen as a national priority and also due to the fact that the variance and changes in digital competences and e-gov usage in these classes was the largest during the period.

The category "Use of e-mail" refers to answers to the survey question "have you sent or received

e-mail in the last 3 months?” The category “use of e-commerce” refers to answers to the question “have you searched the internet for availability or prices of products or services in the last 12 months? The category “use of financial services” refers to answers to the question “have you used Internet Banking for consultation in the last 3 months?” These variables are used as proxies for user competencies that will be considered as antecedents to e-gov usage.

The category “use of e-government” considers the use, in the last 12 months, of any of a series of common e-government services offered to citizens (requesting documents or personal information, paying taxes or service fees, registering for educational or health services, etc).

Binary Logistic Regressions are used to analyze the relationships between the (dichotomous) variables (HAMILTON, 2009). The absence of significant multicollinearity in the data set is verified through VIF and tolerance statistical tests.

According to the research model (Figure 1) the first set of tested relationships (posited as

influences) considered the variables “preferred location of access to the internet” (this categorical variable was transformed into dummies variables) and proxies for use competencies (E-commerce, E-mail and Financial Services). The next set of logistic regressions aimed at assessing the relationships between competencies and the use of e-gov services, followed by a logistic regression of the use of e-gov services against the preferred location of access to the internet.

The software Stata was used for the stepwise logistic regressions. For data analysis, we considered only the odds ratio values that are statistically significant at the 95% confidence level.

4. DATA ANALYSIS

Table 3 shows the location of preferred access to the Internet. Percentages are calculated over the total population of internet users in a social class. Classes A and B and also D and E are combined for convenience of analysis.

Table 3 – Preferred location of access to the Internet of E-gov users’ (percentage)

	AB			C			DE		
	2007	2009	2011	2007	2009	2011	2007	2009	2011
At Home	53.0	63.0	72.7	29.3	36.4	58.5	9.3	16.2	27.2
At Work	26.5	22.6	20.4	21.2	17.3	16.1	8.9	5.3	10.9
At school	2.8	1.2	0.5	3.6	3.5	1.4	4.4	4.8	2.5
At someone else’s home	4.1	4.8	1.6	11.5	10.0	6.8	14.2	17.4	15.5
Telecenter	0.6	0.7	0.3	1.9	1.2	0.4	2.2	1.1	2.9
Lan-House	12.8	7.4	3.2	31.8	31.0	14.7	58.1	54.1	34.7

Source: Research data.

The data show a general increase in access to the internet at home, especially in the lower classes. The Country’s favorable economic situation during the period (growth of household income) and public policies for the reduction of hardware and connection cost allowed the increased affordance of ICT resources at home,

leading to the corresponding reduction of access in other locations. Especially noteworthy is the dwindling demand for the once ubiquitous Lan-houses (many of them already going out of business). Table 4 shows the frequencies of E-mail, E-commerce (search) and Financial Services usage.

Table 4 – Use competences by social class (percentage)

	AB			C			DE		
	2007	2009	2011	2007	2009	2011	2007	2009	2011
E-mail	88.1	89.8	90.1	78.3	80.1	78.4	73.3	71.2	65.5
E-commerce (search)	71.2	77.1	80.6	50.5	59.2	64.3	40.4	40.7	47.2
Financial Services (checks)	27.9	27.1	37.7	13.7	11.6	21.8	8.1	5.4	12.5

Source: Research data.

The variable “usage of electronic government services”, presented in Table 5, is used as the measure for the model’s “Functionings” (SEN, 2001)

Table 5 – Percentage of E-gov users’ (percentage)

	2007	2009	2011
Class A and B (combined)	78.4	77.5	77.7
Class C	69.3	65.4	61.0
Class D and E (combined)	59.4	52.3	44.3

Source: Research data.

Tables 6 to 10 present the results of the logistic regressions. The “odds ratios” presented in these tables should be interpreted as follows: the coefficient 2.5 in Table 6 (Class C, “at Home and Work” in 2007) means that the probability to be a user of e-gov services of a user that has access to the internet from home or work is 2.5 times more likely than that of a user that accesses the internet from another location. Similarly, the coefficient 0.7, being lower than 1, indicates that a user that accesses the internet from a lan-house is less likely to use e-gov, as compared to a user from

another location. Blank cells indicate that the corresponding coefficients are not statistically significant.

Our focus in the analyses is on the usage of e-gov services in Social Classes C and DE, since these classes are the main target of public policies for digital inclusion and also because in these classes there is a larger variation in the overall level of e-gov services adoption and therefore the larger interest and implications of an explanatory model.

Table 6 – Contribution of access location to e-commerce usage (odds ratios)

	C			DE		
	2007	2009	2011	2007	2009	2011
At Home and Work	2.5	2.5	2.1	5.3	2.8	3.4
At someone else’s home				1.9		
Telecenter				4.9		
Lan House	0.7					
Lan House			0.7			

Source: Research data.

Table 7 – Contribution of access location to e-mail usage (odds ratios)

	C			DE		
	2007	2009	2011	2007	2009	2011
At Home and Work	3.4	4.7	2.8	7.1	3.8	
At someone else’s home		1.8	1.6	5.7		0.5
Telecenter	3.2	0.5				
Lan House	1.8	2.5		3.8		

Source: Research data.

Table 8 – Contribution of access location to e-finance usage (odds ratios)

	C			DE		
	2007	2009	2011	2007	2009	2011
<i>At Home and Work</i>	2.3	3.8	2.2	2.2	3.3	4.0
<i>At someone else's home</i>		2.7				
<i>Telecenter</i>						
<i>Lan House</i>			0.7			

Source: Research data.

Coefficients for “At Home and Work” access to the internet in tables 6, 7 and 8, being significantly larger than 1, show that access from these locations is significantly related to an increase in internet usage competencies (as represented by the proxies e-mail, e-commerce and e-finance usage), therefore supporting the first set of propositions of the paper (access location being influencing the capability conversion factor).

Tables 6 and 7 show also some larger than 1 coefficients for the other access locations. In these cases, however, the value of the coefficients falls over time, indicating a reduction of importance of these locations, leading to values less than 1 or non-significant in the last year 2011, thus

supporting the proposition that the eventual users of e-gov services from these locations may have migrated to more the convenient access locations (at home and work).

Table 9 shows that the use of all three services (e-mail, e-commerce and e-finance) contributes significantly to increase the probability of their users being also users of e-government services, with a special weight for e-finance services.

These findings thus support the second part of our research propositions: the developed capabilities influencing the choice for the functioning (use of e-gov services).

Table 9 – Contribution of Capabilities to Functionings (usage of e-gov) (odds ratios)

	C			DE		
	2007	2009	2011	2007	2009	2011
<i>uses E-commerce (search)</i>	3.3	2.0	2.2	2.4	1.9	1.9
<i>uses E-mail</i>	2.0	1.4	2.7		3.1	7.1
<i>uses Financial Services (checks)</i>	5.2	4.1	3.2	3.1		5.9

Source: Research data.

Table 10 – Contribution of the Location of Access to the Internet to the use of E-gov services (odds ratios)

	C			DE		
	2007	2009	2011	2007	2009	2011
<i>At Home and Work</i>	3.5	1.7	1.8	3.4	2.0	
<i>At someone else's home</i>	1.7			2.4	2.4	0.4
<i>Telecenter</i>	3.4	2.9		0.3		
<i>Lan House</i>						0.5

Source: Research data.

Lastly, the coefficients of Table 10 show that Access Location alone, although consistent with the previous results, is a much weaker predictor of e-gov services usage than the process mediated by the usage competencies, indicating the

contribution of the “mediating chain” proposed by the Capability Approach, which concludes our analysis.

5. CONCLUSIONS AND MANAGERIAL IMPLICATIONS

The data analyses support our propositions of the positive contribution of internet access from home or work to the development of internet usage competencies and the contribution of these factors to e-government services usage, as answers to the paper's initial research question.

Managerial and public policy implications: These results show that public policies promoting home access to the internet, such as reducing sales taxes on computers and internet access and low-interest financing for home computers are more effective in leading to an increase in the use of e-government than the effort to reorient lan-houses and telecenters to become e-gov access points.

Home access to the internet contributes to the increase of citizens' e-literacy, also in the lower social classes and has also an impact on their e-gov use. Nevertheless, the lower percentage of e-government services use among lower social classes indicates the need for additional research to better understand the reasons for them not to use these services, even among users that have internet access at home.

In the beginning of the last decade there was a nation-wide boom of private lan-house (most of them very small family-run businesses). Many of them have since closed due to the rapidly falling demand, as shown in Table 3. The results of our study do not support government policies to provide incentives for the still large number of lan-houses and telecenters to become access and support points for e-government services. The theoretical contribution of this paper is to demonstrate the suitability and the development of a methodological approach operationalizing Sen's Capabilities Approach, based on CGI's Brazilian ICT usage variables in order to understand the factors and processes that constrain and influence citizens' decision to use e-gov services. On the other hand, as a contribution to practice, the results of this inquiry could aid in the shaping of alternative public policies for digital inclusion and the analysis of their effectiveness, such as implementation of public telecenters vis-à-vis facilitation of internet access from home and the understanding citizens'

cultural and educational constraints in the process.

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