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**Article (Accepted version)
(Refereed)**

Original citation:

Avgerou, Chrisanthi, Ganzaroli, Andrea, Poulymenakou, Angeliki and Reinhard, Nicolau (2009) Interpreting the trustworthiness of government mediated by information and communication technology: lessons from electronic voting in Brazil. [Information technology for development](#), 15 (2). pp. 133-148.

DOI: [10.1002/itdj.20120](https://doi.org/10.1002/itdj.20120)

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Interpreting the trustworthiness of ICT-mediated government: lessons from electronic voting in Brazil

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Abstract

The electronic voting system of Brazil is understood to be widely trusted by the citizens of the country and international observers. More precisely, it is seen as a trustworthy mechanism of producing elections results that accurately represent the choices of the electorate. In this paper we discuss briefly the concepts of trust and trustworthiness and focus to examine the formation of beliefs regarding the latter. We argue that the belief of trustworthiness is only partly attributable to the perception of the merits of the technical system and its enactment procedures. Significant role in the formation of this belief in the case of the Brazilian electronic elections has played the reputation of the institutional actors responsible for the elections – the Superior and the Regional Electoral Courts. We therefore conclude that, unlike common assumptions about the potential of e-government in developing countries to restore trust in government institutions which are considered untrustworthy, the production of trust in ICT-mediated government services relies on citizens' perceptions of their trustworthiness.

Keywords: electronic voting, institutional trust, trustworthiness, Brazil, developing countries, e-government.

Acknowledgements

We would like to thank the organizations that made our research possible either by funding our empirical study, or by providing valuable data. These include the Inter-American Development Bank, which funded a first cycle of our research in 2004, the TSE in Brasília, the TREs in Sao Paulo and Porto Alegre. From the numerous individuals who helped us to conduct this research we are indebted in particular to Marie Anne Macadar, Amarolinda Saccol, and Isabel de Meiroz Dias.

Interpreting the trustworthiness of ICT-mediated government: lessons from electronic voting in Brazil

Introduction

The research we present in this paper has been triggered by the concerns of international development agencies about the Latin American citizens' low degree of trust in democratic government institutions, as indicated by various opinion surveys (Latinobarómetro, 2004; UNDP, 2004). In current development thinking, economic growth requires 'good government', which comprises transparency in decision making, efficient administration, effective accounting, a reliable legal system, social cohesion, avoidance of corruption, state capability and credibility (Meier, 2001). Lack of citizens' confidence in democratic institutions is a worrying sign of lack of propensity to cooperate, and therefore an obstacle to economic growth. Against the background of such concerns, e-government programmes are generally expected to improve citizens' access to government services, to bring transparency of governments' decisions and activities, and to combat corruption in state administration, thus to restore citizens' trust of government.

The opportunity for our research arose from the Inter-American Development Bank's (IADB) interest in determining the potential of its sponsored e-government projects in the Latin American region to impact on citizens' trust in their governments. One of the ICT applications we chose to study is electronic voting in Brazil. A study of the use of ICT to support the conduct of elections is particularly pertinent to the question of citizens' trust in democratic government because it concerns one of the most fundamental institutions of democracy and is used by all citizens above the age of 18¹.

In our empirical research we found a great deal of evidence that Brazil's electronic voting system is widely used and appreciated, and that the election results it produces are, with few exceptions, accepted to be the correct aggregate of individual citizens' actual votes. Yet, the formation of plausible cause and effect relationships between a technical/institutional arrangement and trust, as expressed in citizens' opinion surveys and demonstrated by their actions, posed a theoretical challenge. Our review of existing literature on trust did not suggest a satisfactory theoretical basis for such a causal relationship. Most of the vast literature on trust concerns interpersonal relationships and is not directly relevant for our study which is concerned with trust in political institutions, such as the various agencies that deliver the services of the modern state. Trust in government is distinct from trust in particular individuals occupying positions in government and administration. Taking an interpretivist stance, we framed our study as an investigation of citizens' belief that government agencies are trustworthy and sought to examine how a technology mediated government service, such as electronic voting, is implicated in this belief.

The paper is structured as follows. In the next section we introduce the concepts pertaining to the question of trust in this research and identify distinctions and relationships that guide the data collection and analysis of our empirical study. We then describe our research in terms of data collection method and process of analysis. In the following section we describe the electronic voting system, its government and broader social context, and its role in the election process and its results. In the discussion section that follows we unravel the way this technology innovation is seen to be associated with changes in the Brazilian citizens' perception of trustworthiness in elections and in democratic government at large. Finally, in the conclusions we

draw some answers to the question whether and under what conditions e-government can be a mechanism for restoring citizens' trust in government institutions.

Disentangling concepts

A large and dispersed literature has highlighted the significance of trust in modern society. Indicatively, in economics and politics trust is a necessary condition for the functioning of the market and the political system (Williamson, 1975; Fukuyama, 1995; Putnam, 2000); in sociology and organizational theory trust is often juxtaposed to control mechanisms of social systems (Luhmann, 1979; Gambetta, 1988; Giddens, 1991). Giddens pointed out the significance of actively creating trust in the expert systems that make the fabric of late modernity (Giddens, 1990; Giddens, 1994). In IS, a stream of publications have reported research on trust as it pertains to new forms of business enabled by the internet, such as virtual teams, and e-commerce and e-government (Jarvenpaa & Leidner, 1999; Ba & Pavlou, 2002; Piccoli & Ives, 2003; Jarvenpaa et al., 2004).

This literature tends to argue for the significance of individuals' attitude of trust towards others as well as towards institutions of their societies. But beyond the general thesis on the importance of trust in modern societyⁱⁱ, the nature of 'trust' and the conditions that foster it remain opaque and controversial. One area of contention, for example, is the extent to which trust in government institutions depends on interpersonal trust (Levi, 1998; Putnam, 2000). Some political theorists argue that the trust individuals form through their lives towards strangers and collectives of strangers in their communities plays an important role in developing trust in the impersonal political institutions of modern democratic societies (Hardin, 1998). Others reverse the causality between interpersonal and political trust. They argue that face-to-face, community based, relations play a limited role in building trust in the institutions of complex societies. Instead, they emphasize the importance of legal and institutional mechanisms, such as the courts of justice, elections, property rights, for fostering trust in other members of a society (Zucker, 1986; Fukuyama, 1995; Cohen, 1999; Levi & Stoker, 2000).

The literature of trust that focuses more specifically on government helped us begin to unpack the common sense view association of ICT-related improvements in government organizations with increasing citizens' trust in government, and to frame conceptually our research question. In particular, we drew from Hardin's analysis on trust and trustworthiness of government (Hardin, 1998; Hardin, 2002). Hardin explains why the general definition of trust that he adopted throughout his studies of interpersonal relationships (trust as 'encapsulated interest'ⁱⁱⁱ) is not appropriate for studying trust in government. In a nutshell, this is mainly because citizens cannot possibly know the interests, incentives, and actions of the individual role holders of government institutions. At best, he suggests, citizens can form 'quasi trust', 'grounded in inductive expectations from past behavior or reputation' about the trustworthiness of government (Hardin, 2002).

Hardin's analysis (2002) indicates the conceptual and epistemological difficulties in grasping the meaning and mechanisms of 'trust in government'. Also, it points our attention to the study of 'reasons for believing government agents to be trustworthy' as an alternative more feasible strategy for beginning to understand how a technology intervention in a government institution may affect citizens' attitude to government.

The distinction between trust and trustworthiness is important for our study of why and how ICT may strengthen citizens' trust in government. It provides a conceptual basis for associating people's perception of a system, a government service, or an institution with their behavioural attitude as citizens.

Trustworthiness vs trust

The concept of trustworthiness refers to the properties through which a trusted entity (whether another person or an institution) serves the interests of the truster, while trust reflects the truster's beliefs, or perceptions, of the entity's trustworthiness (Levi & Stoker, 2000). The relationship between trustworthiness and trust has received a great deal of attention in studies of trust in advanced democracies where surveys show widespread suspicion to the performance of almost all established institutions, such as schools and health care systems. One of the paradoxes in that context is that measures designed to monitor and demonstrate trustworthiness, such as performance indicators, tend to accentuate the problem of low trust, perpetuating a climate of suspicion (O'Neill, 2002). That is, even when performance indicators suggest improvements of services, citizens continue to place low trust in the institutions delivering them.

Two main reasons are discernible in the literature for the mismatch between interventions intended to improve the trustworthiness a government service and trust the service enjoys as a result (Levi & Stoker, 2000; O'Neill, 2002). First, the willingness of citizens to rely on a service depends on their judgment of the overall social and political context that sustains them and is shaped on the basis of more general beliefs and political predispositions. Second, the perception of trustworthiness relies on the cognitive and emotional capacity that individual citizens bring to bear on their experience of a service, on indicators used to describe aspects of trustworthiness, or on informants, such as the media. All of these may misinterpret or misrepresent the resulting service, either towards misplaced trust, or towards excessive suspicion.

Therefore, while it is reasonable to expect that an agency's intentional efforts for the development of trustworthy e-government services potentially contributes to citizens' trust in the agency, it does not determine it. Citizens' perception of the trustworthiness of a government agency is mitigated by their expectations and beliefs about its political underpinning and, as Hardin explains (2002), by the limited knowledge citizens have of the agency actions. For example, citizens' view of the fairness of the policy legislation that a government agency enacts may contribute to a general attitude of suspicion towards it, which conditions the way they perceive the services put in place to support their interaction with the agency.

With this conceptual distinction between trust and trustworthiness in mind, in this paper we focus on exploring perceptions and interpretations of the trustworthiness of e-voting in Brazil. At the conclusions we discuss the limitations of this choice of focus to account for the formation of trust.

Trustworthiness of ICT, ICT-mediated services, and government agencies

We need also to disentangle the entities we study as the object of citizens' trustworthiness judgment in the electronic voting case. Several systems are potentially implicated in such a judgment: specific ICT artifacts, the electronic voting system, the government institution that oversees the elections, the regime of democratic government at large. The central concern of our analysis in this paper is the middle ground of the particular ICT-mediated government service of the conduct of electronic elections. We consider Brazils' e-voting system as a particular 'service'

that comprises the enactment of a set of particular technologies and constitutes part of the overall responsibilities of country's electoral agencies^{iv}. Of interest therefore to us is the way citizens' perception of trustworthiness of a government service (elections) is influenced by the perception of an ICT system (electronic voting system) as a trustworthy interface to the government agency (the electoral agency), or a trustworthy actor involved in the performance of the agency's task.

In the information systems literature it is recognized that, even if successfully implemented, the technology of e-government may not be considered adequately trustworthy to be used and therefore its adoption is itself in need of trust-building mechanisms (Warkentin et al., 2002; Carter & Bélanger, 2005). Based mainly on the technology acceptance model (TAM), the literature has suggested that, in order to be adopted, e-commerce and e-government technologies must be perceived to be useful and easy to use. In addition, the IS literature on trust has emphasized the importance of the technology-based transactions being perceived as secure (Gefen et al., 2003; Carter & Bélanger, 2005; Salam et al., 2005). The usefulness of e-government services is usually associated with specific performance improvements, such as efficiency and effectiveness in delivering a range of services, reduction of corruption, or transparency in the conduct of administration. The issue of security is understood to point to the need for institutional mechanisms that safeguard integrity of transactions, such as certification and escrows (McKnight et al., 2002; Warkentin, Gefen et al., 2002; Pavlou & Gefen, 2004).

Such TAM-based explanations take too narrow a perspective of a user-artifact relationship and cannot account either for the origin of the user perceptions or for their resulting interpretations of these perceptions into beliefs of trustworthiness of the technology-mediated service and the agency that provides it. A recent critique of TAM as non-falsifiable indicates its analytical limitations (Silva, 2007). The study of the way ICT-mediated services, such as electronic elections, are implicated in the formation of beliefs regarding the trustworthiness of government agencies needs to search further than TAM. First, it needs to examine the question why people may or may not perceive the ICT-mediated service as useful, or may not find it easy to use, and therefore what other conditions may influence the views on the trustworthiness of an electronic service. Second, it needs to examine whether beliefs of trustworthiness of an electronic service, may or may not be translated into beliefs about the trustworthiness of the government agency that enacts the ICT-mediated service.

One answer regarding the former that emerged from our empirical study of the electronic voting system in Brazil and seems to be validated by other research is people's predisposition to ICT. The perception of ICT-mediated transaction system as useful, easy, and secure, is related with users' familiarity and existing views about ICT in general. This was demonstrated in a study of the implementation of a GIS system in India by Barrett et al (Barrett et al., 2001). Such a predisposition is formed from prior experience of citizens with ICT, as well as from a shared community view of the practical and symbolic significance of ICT, which is generally captured in the term 'ICT culture' (Leidner & Kayworth, 2006).

There is less research regarding the latter issue of the possible mismatch between people's belief that an ICT-mediated service is trustworthy and their view on the trustworthiness of the government agency that provides the service. We came across an example of this mismatch in our study of the electronic tax system in Brazil. The system was widely used and highly appreciated by the middle class tax payers as easy

to use, useful, and generally trustworthy. Yet, our interviewees' overall view of the tax authorities was rather negative, tainted by their perception of the taxation legislation as unfair to them.

Research Process

We identified the electronic voting system of Brazil as suitable for studying the ICT and trust-in-government relationship through its reputation as a case of successful use of ICT in the government sector. Brazilian elections is an exceptionally trouble free activity within the country's political system of parliamentary democracy. Amidst a climate of continuous allegations of corruptions on virtually all aspects of the conduct of government, elections have been conducted without loud complaints of fraud since the restoration of democracy in the late 1980s. Also, the Brazilian trouble free elections stand out in comparison to elections in other Latin American countries, such as Mexico, where the legitimacy of elections results are often disputed creating political instability.

We conducted an interpretive empirical study that aimed to trace the construction of the electronic voting system; to produce a description of the materiality and functionality of the artifacts involved as well as the organizational, social and political dimensions of its context; to produce a description of the process of elections; and to identify perceptions and beliefs about the trustworthiness of the technology systems, the electronic elections service, and the elections as an institution of democratic government. Central in this research effort has been our fieldwork during two occasions of Brazilian elections: the second round of the municipal elections in the city of Sao Paulo on 31 October 2004, and the first round of the general elections of 2006, on 1st October, for President, Senate, Federal Congress and States Government offices.

Specifically, our data collection focused on the following:

- a) The technology artifacts that comprise the e-voting system and their functionality and the processes through which the system was initially engineered and is updated in between elections. We collected such data through interviews and system demonstrations in the organizations responsible for these technical tasks at the Federal level of government - the Tribunal Superior Eleitoral (TSE) in Brasília - and two state governments - the Tribunais Regionais Eleitorais (TREs) of the state of Sao Paulo and the state of Rio Grande do Sul, in Porto Alegre. In all we had 7 sessions during which teams of systems analysts and project managers presented to us descriptions of the technologies and the story of systems development, answered our questions, and provided us with relevant descriptive documents.
- b) The institutional context of the elections. We sought to form an in depth understanding of the Brazilian government system and the institutions responsible for Federal and State elections (the TSE and TREs) with a variety of formal and informal research methods. These included encyclopedic sources and specialist publications on Brazilian government and politics, interviews with 9 Judges and support staff at the TSE and two TREs we visited in 2004 and 2006, interviews with 4 political scientists in the Universities of Sao Paulo and Brasília.
- c) The process of the elections. We collected descriptive information on the way the process of updating, certifying the validity, distributing, installing, and using the electronic system is intertwined with the legal/organizational process of preparing and conducting the elections. Furthermore, we observed two episodes of elections. During

the 2004 elections we were part of a group of visitors at the Tribunal Regional Eleitoral (TRE) of the state of Sao Paulo and observed the ‘system in action’ in two voting stations. During the 2006 elections two of the authors were part of a group of foreign visitors at the TRE of the state of Rio Grande do Sul, in Porto Alegre^V and observed the installation and preparation of the system in a voting station, the voting process in three voting stations, the ‘parallel run’ testing of the system, the closing of the ballot, the collection of results in a regional results collection centre, and the unfolding of the announcement of election results at the TRE.

d) Views and feelings about the e-voting system, the conduct of elections, and the conduct of politics in Brazil. During our visits to the voting stations we interviewed more than 20 voters. Also, we interviewed one journalist, 5 activists campaigning against the system on the basis that it is insecure, and staff of three NGOs, namely, Transparency International in Sao Paulo, INESC in Brasília, a Jesuit mission in a favela of Porto Alegre.

Our analysis followed a gradual process of research question and argument refinement through the formation of a succession of general conjectures regarding ICT and citizens’ trust and case-specific analyses. The first cycle of our empirical study, during the 2004 elections, started with a broad sensitization from the general multi-disciplinary literature about trust. From our observations and accounts given by our interviewees we constructed descriptions of the system and the conditions of possibility for its development and use. From that first study we became aware of technology security concerns voiced by computer engineers and some political scientists and we noticed that, despite such voices, voters and the political parties did not show signs of doubting the trustworthiness of the election process. Two other observations emerged from our data collection: first, that the trustworthiness of the electronic elections was a continuous concern for the TSE and TREs and was actively cultivated by them in the period between elections as well as at the time of elections, and second that the beliefs in the trustworthiness of the electronic voting system were supported by a general positive attitude towards ICT among citizens. We therefore formed the conjecture that the citizens belief of trustworthiness of the Brazilian ICT-mediated elections implicates three analytically distinguishable elements: the citizens perception of trustworthiness of the electronic voting system; their perception of trustworthiness of the election authorities; and their positive predisposition towards ICT. Consequently the second round of our theory review and empirical research focused on confirming the validity of this conjecture and exploring relationship of these three elements.

Electronic voting in Brazil

The institutional context

Brazil is a presidential and federative republic composed of twenty-six states and the Federal District (Brasília). The authority responsible for the conduct of electoral affairs is the Tribunal Superior Eleitoral (TSE). TSE has jurisdiction over all aspects of elections and regulates the functioning of political parties. The electoral law in Brazil is revised every two years, in correspondence with a new turn of elections. It is the TSE’s responsibility to draft a law resolution to submit to the legislative power for approval. The TSE, over the years, has developed a high reputation for trustworthiness, competence, and autonomy in the management of the electoral process. Therefore, the content of this draft is rarely debated by the legislative.

The management of the elections process is delegated to the Regional Electoral Courts (TRE – Tribunal Regional Eleitoral). Each Court is formed of three judges, who belong to the State Court of Justice. Each State is divided into Electoral Zones, and the total number of electoral zones in the country is 2,900.

The development of the e-voting system

At the beginning of 1995, the TSE formed a task force comprising staff from the TSE and the TREs and financed by the World Bank. The objectives of the task force were to stop fraud and to strengthen political participation and inclusion by simplifying the voting system. The existing system required people to read the names of candidates from a list and to write down their names on the ballot paper, but the level of illiteracy in Brazil was very high, close to 30% of the population. Therefore, they perceived a pressing need not only to improve the user-friendliness of the interface (the ballot paper), but also the knowledge-base required to participate to the process.

After six months the task force produced a proposal for the development of a computerized ballot box and invited technical experts from Federal ministries to participate in defining the system's technical requirements and specifications. At the beginning of September 1995, a team of fourteen technical specialists started working on the system's development and in May 1996 the first copy of the electronic voting machine was released. The machine was tested for the first time in the Municipal elections of October, 1996. The test included all cities with more than 200,000 voters and all state capitals, which involved 33% of the voters. A second test was run for the general election of 1998. This test included all cities with more than 40,000 voters, reaching 67% of the voters. Finally, the system was used in the whole country for the municipal elections of 2000.

Elections preparation

The preparation process starts in December of the year before the elections when the TSE submits to the parliament a draft resolution to update the electoral law. The document does not include technical descriptions of the e-voting system; it reflects the changes needed to enact the law into a new version of the system. The resolution proposed has to be approved by the parliament in March. The TSE, at this point, has one month to review the system according to the requirements specified in the approved resolution.

180 days before elections the software development stops and the new source code is made available to the technical experts of political parties to detect whether the system complies with the law approved. Sixty days before the elections the software is sealed during a public ceremony. Political parties' and civil societies' representatives are invited to participate in order to digitally sign the compiled copy of the software code. During this ceremony a sequence of major events take place. The first is the generation of hash function tables. The second is the digitally signing of the compiled version of the software source code. Finally, the software applications, digitally signed and encrypted, are distributed to the TREs.

A few days before the elections each TRE loads all e-voting machines with the candidate (name, number, party or coalition abbreviation and photo) and voters tables and the software applications. Political parties' representatives are required to attend this loading process. The validation of the loading process is made on a sample of three per cent of the overall population of e-voting machines randomly selected by Parties' representatives.

The day before the elections e-voting machines are put in place. This is a massive operation. In the 2006 general elections 380,945 voting machine were placed in that many voting stations, distributed in 91,244 voting locations, for the voting service of 125,913,479 registered voters.

A percentage of these machines, depending on the number of voters in each State, are taken back to TRE for a simulation of a voting session that consists of two ballot boxes: the electronic voting system, and the traditional ballot box. A sample of randomly collected votes is cast in both systems and the results are compared for consistency.

At 7.30 a.m. on the election day, the president of the precinct turns on the e-voting machine at the presence of voting board's representatives and political parties' ones. The e-voting machine prints out automatically a report, called "zeresima", which certifies that the ballot box is empty, i.e. that there is no candidate with a pre-assigned number of votes.

Functional description of the e-voting system

The voting machine consists of two terminals installed in each polling station. The first is the voting board representatives' terminal and has a numerical keyboard with a two lines liquid crystal screen. It is used by the board representative to type a voter's identification number. If he or she is registered in the precinct, his or her name is displayed on the screen and the identification is accomplished. The board representative checks on the screen the status of the voting machine and, if available, presses 'enter' to turn the machine on the ready state.

The second terminal is the voters' one. When the voter enters the booth, the machine should be on the ready state. The voter terminal is also formed of a keyboard and a liquid crystal display. The voter expresses his/her preference by typing their candidate identification number. The screen shows the candidate's name, initials of the party or coalition he or she belongs to and his or her photo, and if these are correct, voters press enter to confirm. The keyboard has two additional keys: the first is the correction key that allows voters to re-start the process, the second is the blank vote key.

please insert the photo of the machine about here

At 5 p.m. of the election days the president of the precinct uses his or her password to close the voting machine and to print a voting machine report for the precinct. This report contains the following information: precinct's identification code; voting machine's identification code; number of voters who attended and voted; total voting results for each candidate.

The report is printed in five copies. These five copies are signed by the president of the precinct and by the representatives and inspectors of the political parties. One copy is displayed announcing the results of the precinct. Three copies are enclosed to the precincts register and sent to the electoral committee. The last copy is delivered to the political parties committee. If required, the machine can print out five additional copies that can be distributed to the district attorney of the political parties, to representatives of the press and to the public prosecution office. The copy that is delivered to the political parties committee is extremely important, because it allows parties to check whether the data have been modified during transmission. Upon data reception, the TRE and the TSE send an electronic receipt to political parties.

The voting machine program saves the data on a diskette in an encrypted format to prevent data modification and the diskette is delivered to the local electoral committee.

Data are then decrypted and uploaded with a “guiding program”. The process, at this point, varies according to the type of election. In the case of municipal elections the data is totally-added at the precinct of the municipality and then transferred to the local TRE and to the TSE. In the case of general election the data are read at the precinct that corresponds to the municipality and transmitted to the local TRE and to TSE. The data on votes for the President of the Republic are added up and announced by the TSE.

The technical trustworthiness of the entire system is ensured by a security infrastructure aiming at preventing data from being intentionally or unintentionally modified and/or deleted. The security of the system comprises the system audit program, which records all transactions performed on the particular machine, and the system security program, which prevents any tampering with the voting machine, such as the removal of the diskette on which election votes are stored.

Discussion

Perceptions of trustworthiness of the electronic voting system

The electronic voting system of Brazil has several qualities that make it, and consequently the elections, perceived to be trustworthy. It is indeed generally seen as easy to use, thus satisfying a basic criterion of user acceptance suggested in the IS literature on trust. The voting machine has a very simple interface, comprising an unambiguous presentation of voting options, confirmation and cancellation procedures, pictures of candidates and Braille coding on the buttons to secure universal access including illiterate and blind people.

In addition, it is appreciated by different stakeholders for various efficiency effects. Representatives of political parties, political scientists, and NGOs valued the system for allowing illiterate people to vote and for reducing the percentage of spoilt votes due to unreadable handwriting. Voting is compulsory in Brazil, and therefore the number of people voting is not a good indication of their views of the trustworthiness of the elections, or the value of the elections as a democratic institution. However, there has, at various periods in the past, been a large proportion of invalid votes. In the 1990 and 1994 elections (i.e. before the electronic voting system) the rate of invalid votes^{vi} exceeded 40% of the ballots cast. In 1998 the invalid votes fell by half, and in 2002 - when the system as used in the whole country - they fell again to 7.6% of the total number of votes cast. Political analysts attribute the reduction of invalid votes partly to the introduction of the electronic voting system and explain it as a matter of simplifying the previous too complex manual system of voting and counting of votes^{vii} (Limongi, 2006)^{viii}.

Voters seems to appreciate the problem-free experience of voting. The fast and uncrowded voting experience created a relaxed and almost celebratory atmosphere at the voting stations we visited. Many parents took their young children with them to the voting booth to show them how they used the machine. The judges we interviewed pointed out that they do not now spend time at voting stations overseeing the voting; instead they concentrate their attention to other potential types of electoral fraud, such as political parties influencing the voting choices at the vicinity of the voting stations. Moreover, many interviewees noted that the counting of votes takes considerably less time than it used to do in the manual voting system and the speed in announcement of the election results increased dramatically. Indicatively, in the 2004 municipal elections

99% of the votes (more than 100 million votes) were counted within five hours from the closing of the voting stations.

Overall, opinion surveys and behaviour indicators tend to confirm that the election process is widely believed to be trustworthy. A survey conducted by non-governmental agencies^{ix} in 2004 showed that 81.5% of the respondents have full or partial confidence in the Electoral Justice institution, with 89.5% of them judging positively the services it provides, and 96.7% judging positively the speed of the counting of votes. Moreover we found no disputes over results, even in cases that the votes gained by competing candidates were very close. There were no incidents of challenging the validity of the vote counts such as those in the much publicised cases of electronic voting in USA states.

Positive predisposition towards ICT

The perception of trustworthiness enjoyed by the electronic voting system was compatible with, and we believe was enabled by, a general positive attitude towards ICT in Brazil. The view that ICT is a modernizing and facilitating means for government and the economy is widespread amidst the middle income population of Brazil. The country made an early start in the use and production of IT and pursued sustained computerization efforts despite its frequent crises of economic and political instability (Tigre, 2003). Government computerization (and more recently e-government) tapped onto and further contributed to the development of local ICT expertise^x. Advanced ICT use in the banks at the period of hyperinflation of the 1980s familiarized citizens with ICT as a trusted facilitator of services. Today Brazilians make extensive use of electronic payment systems and e-commerce increases rapidly^{xi}. They came to expect similar convenience from their transactions with the government sector.

There have been also many efforts by Federal, State, and Municipal governments, as well as by NGOs to provide access to ICT in poor communities throughout the country, spreading the message that ICT is *sine qua non* for inclusion in the modern economy. Today there are layers of IT infrastructure in most of the Federal and State government agencies, providing electronic transactions with business and banks, and an increasing range of internet transactions with citizens. And through the electronic elections, ICT further gained in popularity as means that modernize the state and boost the economy, used by all, rich and poor, and facilitating a democratic institution.

In short, the general familiarity of citizens with ICT and their positive predisposition towards its use from prior experience with the electronic services of powerful and successful institutions, such as banks, seems to have facilitated by analogy the belief that the electronic elections are trustworthy. This is an important observation because Brazil is rather exceptional among developing countries for its extensive capabilities to construct and use ICT. In countries where citizens have either little or negative experience with ICT use, ICT-mediated government services may not be easily perceived as trustworthy.

Perception of trustworthiness of the election authorities

Our study suggests that the perception of trustworthiness of the electronic voting system is reciprocal with the perception of trustworthiness of the TSE and the TREs. As the voting part of the elections process is generally believed to be trustworthy, the overall perception of trustworthiness of the electoral authorities is increased^{xii}. At the

same time, the perception of the trustworthiness of the voting system relies on the perception of the TSE as a trustworthy guarantor of the election process. This became clear to us with the controversy over the system's security.

The security of the system is a contentious issue. The system makes extensive use of digital authentication mechanisms and encryption techniques (for the software loaded on the machines as well as the votes cast) as well as physical security measures, such as the paper sealing and signing of the disk and flash card entrance slots of the machines. There is also a range of possibilities provided by the TSE for auditing of the system. Yet, some computer scientists, political scientists, journalists, legal experts, and a small political party have voiced concerns^{xiii}. Central among their criticism of the system security is the lack of a paper log of votes. The TSE has recently amended the system to record individual votes (in random order in order to maintain anonymity of voting) but still the totally electronic form of the votes precludes resorting to the counting of votes recorded on paper in case there is a dispute. There are also concerns about inadequacy of the auditing allowed prior to the elections. Complaints include the limited parts of source code available to political parties for inspection (the commercial operating systems of some of the machines is a particular cause of concern) and the lack of testing of the systems performance by political parties representatives and other interested individuals. Moreover, the current identification of voters at the voting station is considered unsatisfactory.

This last point is the only concern the TSE acknowledges as valid and is now considering the implementation of electronic means of voters' identification, such as checking of fingerprints. The TSE considers the printing of votes to be a source of inefficiency and, potentially, of fraud^{xiv}. Also, they argue that the current limitations of auditing are necessary precautions against external interference with the system. For example, allowing hands-on testing of the system may open possibilities of altering the software code before the digital sealing.

In effect, the security of the electronic voting system is considered robust in terms of preventing external fraud – though not un-breachable - but relies heavily on the guardian authorities, the TSE and the TREs. Indicatively, in addressing requests for strengthening the technical and auditing means for the security of the system, the TSE replied 'the guarantee of the security of the electronic elections is us'^{xv}. The TSE is a competent and powerful actor in the political system of the country. It is actively cultivating perceptions of trustworthiness in the election system by demonstrating the electronic system through television and school education, and creating publicity about the preparation of the electronic elections.

In short, there is a mutual reinforcement of the perception of trustworthiness of the electronic system and its hosting government agency. While the electronic voting system is contributing to the perception of Brazilian elections as an efficient and fair exercise of a democratic right, it relies on expectations of the competent overseeing by the TSE. The system is believed to be trustworthy to the extent that the TSE is believed not to abuse its power. The TSE, already very powerful in the Brazilian politics^{xvi}, has boosted its legitimacy by modernizing elections through a domestically made trustworthy technology that is highly praised internationally and is now transferred to other countries. At the same time, its own trustworthiness is a necessary element for fraud-free use of the electronic system.

Conclusions

We can now examine how far our study has gone towards providing an answer to the question regarding the possibility of e-government to restore citizens' trust in democratic government that triggered our research. Clearly, the framing of our study as an exploration of citizens' beliefs in the trustworthiness of the electronic voting service and the government agency responsible for the elections has a limited capacity to answer the initial broad question on the relationship between the implementation of ICT-mediated-services and trust-in-government. First, our focus on beliefs about trustworthiness considered a more narrow aspect than trust. Belief in trustworthiness is a cognitive concept, which cannot capture accurately citizens' feelings and behavioural attitude towards democratic government. A study of trust will have to go beyond the tracing of perceptions and beliefs and to investigate citizens' political actions.

Second, with our focus on the electronic voting service in relation to the electoral agency that hosts it we have not been able to examine whether and how belief of trustworthiness of the services of an agency scale up to belief of trustworthiness of democratic government. We have found some indication for caution about the assumption of possibility of such scaling up. Simply put, the perception whether elections are trustworthy may weigh little for categories of poor population who do not expect that a democratically elected government will improve their life conditions. We came across anecdotal stories of people in remote poor communities willing to 'sell' their vote for the promise of a job in a local factory, or for a 'gift' such as the payment of a medical treatment. These stories indicate that fair elections may not be considered important if democratic government is not seen to bring about satisfactory life conditions. In such a case, belief in the trustworthiness of electronic elections will probably make little difference for those citizens' trust in democratic government.

But while our study falls short of constructing arguments about the relationship of the implementation ICT-mediated-services and trust-in-government, it makes a start for an analysis of this complex and opaque relationship, and contributes some tentative arguments about its constituent components. Our distinction between trust and trustworthiness and the differentiation among a number of interrelated entities whose trustworthiness may be at stake are analytical steps for the unpacking of the hypothesized overarching relationship of ICT and trust in government. Our focus on beliefs about the trustworthiness led us to identify additional judgements that affect citizens' views about the electronic elections. Specifically, we discussed briefly the facilitating influence of the perception ICT as a technology with modernizing potential in multiple spheres of public life, and of the electoral agency as a competent guarantor of the elections.

Even from these limited findings we can deduce that the expectation of many governments in developing countries and development agencies that the implementation of e-government in dysfunctional government agencies will result in improved services and thus will remedy the broken trust of citizens in democratic government is misguided. The Brazilian citizens' view of the trustworthiness of the electronic elections relies on their belief of the TSE itself being trustworthy and committed to its mission of fair elections. Moreover, this case of e-government built on existing technological competence and a propensity of citizens to welcome government initiatives for ICT innovation. Such conditions of ICT competence and culture are not common in many developing countries, most of which rely on transferring ICT from abroad and often face suspicion about its appropriateness. Therefore, the emulation of

the success of the Brazilian electronic voting system in countries with electoral institutions which do not enjoy citizens' confidence as guardians of democratic elections and with weak ICT capabilities is rather unlikely.

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The voting machine



ⁱ In Brazil voting is obligatory for citizens aged 18 to 65 and voluntary for those aged 16 to 18.

ⁱⁱ There is some disagreement as to whether trust is important in modern society, see for example Cook, K. S., Hardin, R. & Levi, M. (2005). *Cooperation without trust?* New York, Russell Sage Foundation., with some political analysts taking the view that trustworthiness of political institutions is more important than citizens trust in them Hardin, R. (2002). *Trust & Trustworthiness*. New York, Russel Sage..

ⁱⁱⁱ Encapsulated trust is defined as the rational expectations of the truster grounded in the likely interests of the trusted

^{iv} The electoral agencies of Brazil have a broader mission than the running the elections. They are part of the country's judicial system and have overall jurisdiction for electoral affairs. This includes revising and proposing the electoral law, regulating the functioning of political parties, registering candidates and certifying those elected, judging cases of election-related fraud.

^v This research account does not include the participation of the Brazilian author of this paper in the elections as a 'user' of the electronic voting system. Informally, the Brazilian author has been a constant source of explanations and insights for the whole research team.

^{vi} Invalid votes includes blank votes and null votes, both of which are discarded at the election results counts.

^{vii} Electronic voting appears to have made a difference in the null votes of the proportional elections for the House of Parliament and State Congress, which had very complicated ballot papers. They made no positive difference in the majority elections for President, for which indication of choice of candidate was relatively simple in the paper ballot too.

^{viii} However, invalid votes may not be the result of an awkward voting system only. An invalid vote may be cast intentionally, as means of expressing a voter's protest against government, or his/her indifference to elections.

^{ix} TV Cultura and the Nexus Institute.

^x The e-voting system itself (hardware and software) has been developed with indigenous expertise and there are deals to sell it in other Latin-American countries interesting in adopting electronic elections.

^{xi} For indicators of use of electronic payment systems, see <http://www.bcb.gov.br>; for indicators on e-commerce in Brazil, see <http://e-commerce.org.br>.

^{xii} The reputation of the TREs and the TSE lies heavily on their judicial role for cases of election-related fraud. There was a great deal of public concern about other types of electoral crime, mainly of candidates buying votes and political parties influencing unfairly the choices of voters.

^{xiii} See <http://www.votoseguro.org>; Amílcar Brunazo Filho & Maria Aparecida Cortiz *Fraudes & Defesas no Voto Electronico*, AllPrint, São Paulo, 2006.

^{xiv} Up to the 2002 elections the voting machines produced printed votes too. The printing of votes was deemed a source of inefficiency, causing delays in the voting process with frequent printer failures. Moreover, printed votes were considered by the TSE to be a further source of fraud, as voters could potentially corrupt them and claim inconsistency between their printed vote and the count of the electronic system. The digital recording and signing of every vote, introduced in 2004, is considered by the TSE a more effective proof of the accurate counting of votes produced by the system.

^{xv} From an interview with a political scientist, activist of 'voto seguro'.

^{xvi} The TSE is both regulating elections and enacts its regulations. Its accountability is therefore weak.