A New Model for Digital Inclusion in Brazilian Cities

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Abstract. The advances in telecommunications, Internet and computers have brought a new challenge to our society: the digital divide, i.e., the division between people who do and people who do not have access to – and the capability to use – modern information technology. Although most efforts have been on providing computer-infrastructure to all, actual digital inclusion implies allowing people to access information, to provide information, as well as to assure the communication has been effective. We claim Artificial Intelligence techniques play an essential role making feasible actual digital inclusion. We analyze three Brazilian cities in different stages of digital inclusion emphasizing the gap between the political digital inclusion goal and the unfeasible environment created by current city digital inclusion strategy. We proposed a model based on natural language, text mining, data mining and fuzzy logic techniques to create tools for reverting the enormous social debt and incrementing democracy.

1 Introduction

As one of the highlighted items on the agenda of international discussions held in forums such as the United Nations, digital inclusion has been pointed out as being one of the fundamental paths towards improving democracy and reducing social inequality and poverty. Success stories of political inclusion range from underdeveloped countries such as Brazil and India, to countries torn apart by war or environmental disasters such as Afghanistan and El Salvador. These experiences contemplate, for example, the use of public Information and Communication Technologies (ICTs). By implementing the so-called e-governance, a greater participation of the population in the decision-making process is sought, as well as greater control of the State's actions. That way, through the Internet, one could access the budget and investment plans of a determined city, not to mention send and receive complaints and suggestions for the application of public resources.

Nevertheless, despite the dizzying expansion of Internet access – in four years, more than fifty million new users throughout the world were counted [1]– the

infrastructure difficulties are considered the main barriers toward digital inclusion. In Brazil [2], with a population of roughly 180 million inhabitants, 38% do not have telephone services, only 14% have a computer at home, and 10% alone have access to the Internet, as 86% of the Brazilian municipalities do not have Internet service providers. Government initiatives to install terminals with free Internet access in schools and community centers, and NGO actions, such as the Committee for the Democratization of Computers, which mediates microcomputer donations to needy communities, have been applied in order to try to resolve these structural restrictions.

Despite the focus given to the infrastructure limitation, the end of digital exclusion does not depend merely on increasing the number of telephone lines, Internet providers, and access terminal. In other words, it is not enough to offer the population more microcomputers with Internet access. Considering digital inclusion means guaranteeing the interaction of users with the systems offered on the Internet, and also conferring usability and agility to the process of information exchange via the network. Beyond the user/system interaction, which will guarantee the user can speak and be heard; there must be an investment in programs for capacitating the potential users of these new technologies, offering training in the use of the ICTs.

Outside of infrastructure improvements, investments in human-computer interaction and usability, it is also necessary to apply techniques as Artificial Intelligence to the ICTs to help process the data and information circulating through the systems.

These three areas – infrastructure, usability, and AI – are fundamental towards the establishing of full-fledged digital inclusion, especially when discussing e-governance. E-government is the great hope for the revitalization of democracy in post-modern times. It consists of calling the population to opine on the public policies and investments, and to offer them control over the actions of local government via the Internet. In order for e-democracy to work however, the population must have access to the Internet (infrastructure) and have their suggestions and demands processed and heard (usability and AI investments).

Otherwise, even if a proper infrastructure is offered, a poor use of the ICTs, with systems suffering from usability and interaction issues, may compromise the e-democracy process. Placed in front of a computer with Internet access, the population would access hard-to-understand systems, be unable to guarantee they are heard, and see their expectations frustrated after having been summoned to participate.

This paper starts by discussing the importance of the digital inclusion and e-governance to improve democracy and social equality in the world. After, we discuss three prototypical attempts to make people participate more in the decision-making process: *Arraial do Cabo* (Brazil), *Piraí* (Brazil) and *Rio das Ostras* (Brazil). The emphasis is to show that the introduction of ICT to connect politicians and citizens by means of information, voting, polling or discussion [3] may lead to a total failure when done only incrementally. We argue that there is no digital inclusion if investments are limited to the infrastructure. We then present the necessary ICT ingredients to support deliberative democracy.

2 Digital Inclusion

During the first phase of the World Summit on the Information Society, Wsis, in December 2003, leaders from around the world, from NGOs and research centers, made an ambitious Declaration of Principles and an extensive Plan of Action. They stated their challenge was to harness the potential of information and communication technology in order to promote the development goals of the Millennium Declaration. This means that today, using the ICTs and promoting digital inclusion can be powerful tools to reduce the world's social divide. The most important goals were the eradication of extreme poverty and hunger in underdeveloped countries; the achievement of universal primary education, the reduction of child mortality and improving health, such as fighting HIV/AIDS, malaria and other diseases.

The large number of panels and essays presented on experiments around the world confirm the diversity of opportunities for ICTs. The United Nations Cyberschoolbus [4], for example, an online educational resource for students and teachers, has as its primary goals to build a global online community where teachers and students can express ideas and share information, offering opportunities for students to participate in finding solutions to global problems. Another interesting experience is the CDI, the Committee for Democracy in Information Technology, a non-profit, non-governmental organization that, since 1995, has been developing a pioneering initiative to promote social inclusion, by using information technology as a citizen's rights and development tool. They provide the equipment (hardware and software), training of instructors, and administrative and technical support. In some Brazilian communities, known as favelas (similar to slums), where the streets have neither pavement, nor the houses any numbering, children and adolescents with access to the Internet through the CDI, have a virtual name and address and can communicate with other youths around the world. This initiative, which began at the hands of a young Rio de Janeiro executive, today has regional offices in 19 Brazilian States, as well as in Colombia, Uruguay, Chile, Mexico, Guatemala, Honduras, Japan, Angola, South Africa and Argentina.

Nevertheless, if the Internet and new technologies have been overcoming cultural and national barriers, with an infinite field of social action, the same structural problems they are supposed to fight can become a stumbling block toward the universal access to ICTs. If on the one hand we have the vertiginous increase in the number of users of these new technologies – only in 2000, the internet gained 100 million more users - , the profound infrastructure difficulties still limit the range of digital inclusion. In Brazil, a country with 180 million inhabitants, for every 100 inhabitants for example, only 15 have a telephone line, which is 4 times less that the US (67) and France (58). In India and Haiti, these numbers fall to 3 and 1 respectively. Furthermore, whereas in the US, almost 35% of the population has access to the Internet, this number falls to 10% in Brazil, and 0.07% in Haiti. One can conclude nevertheless that digital inclusion is intimately linked to the level of a country's development.

2.1 e-Governance

The Internet has being pointed out as a hope to revive and improve democracy. According to the principles of digital inclusion and by using ICTs, people are being asked to follow and choose the government's decisions. In this so-called e-democracy, the population has the opportunity to consult, vote and opine on the decision-making process via the Internet. E-governance's primary goal is to provide greater transparency to the public administration and improve citizen participation.

Canada is considered the country where e-government initiatives are best developed. An Accenture study noted that the users' satisfaction is the most important factor driving the development of online government services in the country. They can access the public costs and budget, and choose who will represent their interests. According to an NFO Cfgroup [5] study, two out of three Canadian Internet users say they would vote on federal, provincial and municipal elections over the Net if the option were available to them.

However, if on the one hand, e-governance uses the new technologies to facilitate people's access to public administration, on the other hand, it is necessary to guarantee that citizens devise, vote and consult their own demands, not to mention discuss them in the Web forums created. It means that they must adopt a fully active role in the construction and affirmation of the decision-making process. The possibility of speaking and opining, through the ICTs, is an enormous step forward to greater democracy but it must be on the condition that the development of systems guarantees that the users' discussions and demands will be heard. Otherwise, the incomplete deployment of ICTs can destroy the entire process of bringing in people's participation and commitment.

In the table 1, we present the five countries infrastructures indicatives.

Table 1. Statistical Data from www.cyberschool.un.org (2001)

Countries	Telephone Lines per person	Internet Users	Population
Brazil	15%	5.000.000	172.559.000
USA	67%	95.354.000	285.296.000
France	58%	8.500.000	59.453.000
India	3%	5.000.000	1.025.096.000
Haiti	1%	6.000	8.270.000

3 Three Brazilian Digital Inclusion Cases

In this section, we discuss three attempts to bring the population closer to the State's decision-making process: Arraial do Cabo (Brazil), Piraí (Brazil) and Rio das Ostras (Brazil). These three experiences emphasize the concerns that we should have when introducing ICT to assist democracy and to improve digital inclusion.

3.1 The Arraial do Cabo Case

Arraial do Cabo is a small Brazilian city (23 thousands inhabitants) in southwestern Brazil. In the last four years, the city has tried to implement the Participatory Public Budgeting (PPB) as dozens of Brazilian cities have. The PPB is the process through which the population formulates its priorities and then decides, in a direct and democratic manner, on the application of government resources in public works and services to be executed by the municipal administration. Its purpose was to bring people back to the State decision-making process [6] return their faith in it, and endow greater transparency to the formulation and execution of its priorities. In the beginning, it was the initiative of a political party that, once in government, opted for this kind of massive democracy. Soon, other political parties understood that it was a practice independent of any political bias in the municipal administration, and, consequently, the number of participating cities grew.

In Arraial do Cabo, the participation of its citizens consists of face-to-face meetings, just as we think people did in Athens. In the beginning, people's distrust led to low program adherence, but the response increased as they began to feel they were being heard. The number of participants grew so much that the mayor was swamped in suggestions and was no longer able to completely respond to them. In the past two years, the population's enthusiasm has decreased. There is no ICT involved and the participation is mostly in periodical meetings. In order to bring back public participation, city administrators must adopt ICT to overcome the blizzard of information.

The flaws of the experience are the absence of scalability, since as the city grows this kind of participation becomes more and more difficult due to traffic problems: the increasing distance between homes and venues, not to mention the scarce contact between citizens. We need to also point out the population's increased expectations not fully met by the process.

3.2 The Piraí Case

The privatization of a large electrical company sometime in the 90s, painted a desolate picture for the Piraí municipality, where one of the company's branches was located. Close to 1,200 people were let go, causing a significant economical and social impact in this city of 22.500 inhabitants.

In order to overcome this, a development program was set forth, at the initiative of the city hall, which over the following four years created as many jobs as had been left jobless by the privatization of the electrical company. Innovative public policies such as the creation of industrial joint ownerships, fish culture, and co-operative enterprises, entitled the Piraí municipality in 2001 to the Award for Public Administration and Citizenship by the FORD Foundation and Getúlio Vargas Foundation of São Paulo (FGV-SP) [7]. This award is based on the recognition of administrative and public service innovations based on a study by the FGV-SP, the title for which illustrated the city's return to growth: Beating the odds.

Aiming to expand the population's access to public policies and services, not to mention information on the decision-making processes and investments, new technologies and means of communications were researched. The result was *Piraí Digital*, a project developed from the partnership between Piraí city hall, Faperj, the

Fluminense Federal University and VIVA-RIO, a non-governmental organization from Rio de Janeiro. The program consisted of interconnecting all of the city's regions via a digital network. That way the population could access, via the Web, computerized terminals in schools, hospitals, stands in public squares and other public venues.

According to the official site of the Piraí city hall, the main purposes of the *Piraí Digital* project are: modernize the municipality's public services by speeding the transmission and reception of information via the digital networks; provide greater transparency and trustworthiness to the Municipal Administration; and increase the populace's participation in the decisions regarding priorities and investments.

The project is divided into four fields of action. The first, Dot.gov, handles the modernization of the municipal administration through the interconnection of the public institutions. It is hoped that the exchange of information will be accelerated, reducing time and resources needed. The second area, Dot.org, will establish partnerships with NGOs and universities in order to implement initiatives in the fields of education and community development. Dot.Edu will take care of the digital integration of the city's entire educational network, increasing access to new knowledge offered by the Internet and easing the administration of the entire educational system. The fourth area, Dot.Com, handles the telecommunications infrastructure network. The city will be connected by High Bandwidth Radio links and the buildings will be connected by cables.

As the Piraí Digital Program is already at an advanced stage of implementation – with 44 public access points already installed and 18 schools connected – it was recently presented during the Wsis, World Summit in Information Society [8], in Geneva, Switzerland, as an important case of digital inclusion.

Despite the valid initiative in seeking to integrate the entire city into a digital network and make information available regarding the public administration and services, the Piraí Digital project is restricted to resolving infrastructure problems, without developing systems that guarantee the effective participation of the populace. The ICTs will have to be applied observing the importance of the user interaction with the systems' information and usability, or in other words their ability to obtain information, as well as their ability to send their demands and suggestions regarding the community's investments and priorities, and have them processed.

3.3 The Rio das Ostras Case

Rio das Ostras is a medium-scale Brazilian city (45 thousand inhabitants) located about 2 hours by car from Rio de Janeiro. The city has grown fast since they started receiving petroleum royalties 10 years ago. The mayor is at the end of his second 4-year term, yet even today, when he is close to completing his last possible term as Rio das Ostras's mayor, he enjoys a 91% approval rate.

In his first term he put into practice his party's government proposition; i.e., the Participatory Public Budgeting (PPB). During the first years, Rio das Ostras's mayor's efforts focused on making citizens aware of their new role in the city's management. Breaking the population's inertia, as passive spectators, became the mayor's main initial challenge. It took five years to modify the population's behavior.

Now, they realize PPB has given them an opportunity to be heard. Most suggestions addressed local issues such as street paving, schools, and hospitals, whereas city macro planning remained with the government team.

As the population adhered to the program, the demand for meetings overwhelmed the program placing its feasibility at risk. The natural solution adopted was to embed information technology in the process. They created a Web site in which any citizen could directly submit suggestions to the government. The population's expectation grew since they expected that ICT allowed them to be fully heard. Unfortunately, after two years of ICT inclusion, the population is disappointed, which in turn has jeopardized the PPB itself.

Among the problems, we outline the following:

1) **Overwhelming number of suggestions**: too many suggestions have been sent to the government's team, but the team cannot process them all.

2) **Increase in population expectations**: since ICT allows everybody to voice their opinion, the population participates believing that they will all be heard by the government.

3) **Participation Bias**: Most Web participants live out of town, so they use the Web as a way to guarantee elite domination.

All of the above reasons led to a major consequence: popular distrust of the system, and democracy was once more jeopardized. The population got frustrated because they tried, but the participation cost was increased with the introduction of ICT. To make things worse, most people who successfully used ICT to participate were not heard.

In summary: using ICT only for suggestion input and information retrieval jeopardized the whole process of reaching a deliberative democracy.

In table 2, we present the three cities position in the Brazilian digital inclusion ranking.

Table 2. Brazilian Digital Inclusion General Ranking

City	Position
Rio das Ostras	293rd
Piraí	670th
Arraial do Cabo	960th

4 Electronic Participatory Public Budgeting (e-PPB)

In order to obtain an effective digital inclusion, it is necessary to allow people to access information, to provide more information and to receive feedback on their contribution. When people send suggestions, they expect the government to reflect on their contribution. This expectation causes a big challenge to government staff. The huge amount of information sent to the city hall must be understood. The staff needs to categorize and rank the claims, to anticipate the trends and to offer some feedback to the senders.

Artificial Intelligence is a mature knowledge area that offers sound technologies that can make a significant contribution to the digital inclusion challenge, in special:

- Agent technologies to assist people retrieving information;
- Natural language processing to preprocess the messages sent;
- Text Mining and Data mining to extract tendencies from the huge mass of data generated by the messages;
- Heuristic systems and fussy logic to define relevancy

In order to illustrate our point we'll show an application in e-PPB. We claim ICT can assist democracy and improve digital inclusion only when ALL the following components are present.

- Access information (LISTEN): people must be able to educate themselves on what the government is doing that may affect them. The Internet is a natural answer to that.

- Send information (SPEAK UP): people should be able to do more than only choose among possible options formulated by the Elite. ICT must provide a channel to gather the individual needs.

- Allow suggestions to be understood (BE HEARD): the government MUST be able to process all suggestions sent, no matter the volume.

- Get an answer (ACKNOWLDGEMENT): the population must trust they will be heard.

- Verify suggestion status (ACTUAL PARTICIPATION): the population must be informed what will be done about their suggestions.

In Figure 1, we present e-PPB that uses Artificial Intelligence techniques as key ICT elements to make tele-democracy feasible. We will implant this model in Rio das Ostras probably in 2004. We expect to revitalize the democratic objective of PPB.
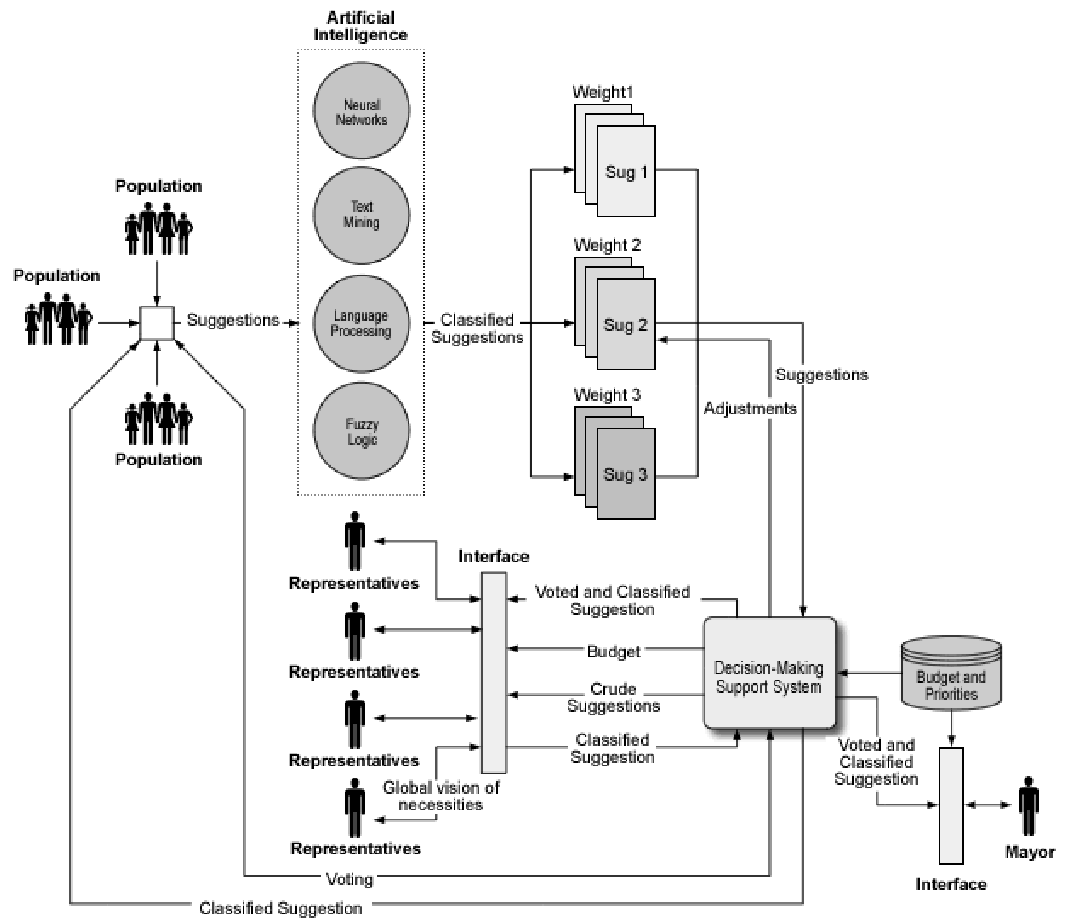
Fig. 1. Electronic Participatory Design Model: AI techniques are used to interpret, categorize, and classify suggestions; and Decision Support Systems are used to assist the formulation of policies from the interpreted summary of suggestion

5 Conclusion

In this paper, we discussed the use of artificial intelligence techniques, in special data mining, to allow actual digital inclusion. We analyzed three Brazilian cities in different stages of digital inclusion, emphasizing the government selected technical approach as mistaken to achieve their goal. They fall into the common international mistake to consider the digital inclusion solution as infrastructure provision. We took a broader view. People will feel included if they can listen (access information), talk (send suggestions to government) and be heard (verify the effects promoted by their suggestions). For accomplishing such extensive goal the solution have to comply to:

- Infrastructure: yes, people need to be able to have access to the net (computer and telecommunication infrastructure)
- Learnable interactions: people must be able to learn how to find information they need and how to enter information they want to send; and
- Personal attention: the individual must fell heard, understood, and a decision-making participant (even if slightly).

The first point is the fundamental investment in the infrastructure so that all might access the ICTs and all of its possibilities. The second is that one must invest in the interaction of the user with the systems, designing friendly interfaces in which they can speak and be heard. The third point concerns the use of layers of AI in order to process the information sent and to ensure its timely and qualitative reception. We have tried to demonstrate the necessity of the implementation of these three points through the analysis of the cases presented. In the first, that of Arraial do Cabo, there is already a commitment of the community regarding the discussion of the city's demands and priorities. However, the budgetary restrictions and the lack of knowledge of the ICTs have placed the municipality in an unfavorable position in Brazil's digital inclusion ranking. In the second case, that of Piraí, there has been a strong investment in making the Internet and the city's computerized terminals available, setting goals to further facilitate access in the schools and community centers. The purpose is to use the technology, the Internet in particular, to disseminate information and integrate the city's administrative branches. However, we haven't found any mention of the use of ICTs to allow a more active participation of the population in the decision-making process, so that they might send demands or suggestions through the Internet and vote on them. The third case, that of Rio das Ostras, where the PPB is available on-line, consists of technology used to open a channel for public manifestation, such as an e-mail to authorities. People can then follow the administration's programs and indirectly develop public opinion movements against or in support of an issue.

However it is impossible to give personal attention to the flow of messages directed to public officials and soon the public becomes disappointed by the poor responsiveness their demands receive. There is no guarantee to the population that their demands are heard due to the large volume of information received. In other words, in terms of public satisfaction the Rio das Ostras digital inclusion project could in fact be disastrous because it introduces further costs, overloads public officials and subsequently infuriates concerned citizens.

What we propose with the e-PPB, an interactive system of deliberation, is to apply layers of AI to interpret, filter the messages sent to the administration and their content, allowing administrators to respond selectively to messages, thus minimizing the discomfort of the "lack of attention" present. With e-PPB, people will feel they are participating so that the democratic process and the digital inclusion are improved as a whole.

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