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M – COGNOCRACY: BUILDING PARTICIPATORY DEMOCRACY THROUGH THE ELECTRONIC VOTING AND MOBILE ICT

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ABSTRACT

To many people, the exercise of democracy and participation in politics has become a synonym for election, an event where ordinary citizens are the leading actors only on the voting day, once every two or four years.

This causes the decrease of citizen participation in the world, bringing about what has been called the crisis of political parties. The use of information technologies and communication technologies (ICTs) and new ways of participation in city governments through the exercise of the so-called Participatory Budgeting (PP) are an effective means to reverse the apathy of citizens. But in order to obtain the desired effect, these new ways of participation must have two characteristics. The first one is to reach the greatest number of citizens, who should be able to exercise their right to participate in a simple and safe way; and the second one, that they somehow summarize the citizen preferences through results that represent them. This paper presents a new way of citizen participation called m-cognocracy, that using mobile

communication technology and mathematical aggregation operators Ordered Weighted Averaging (OWA), provide a new model for citizen participation in the government of cities.

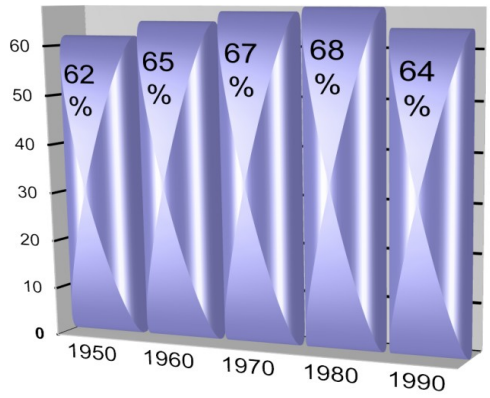
KEY WORD: Participatory Budgeting; Participatory democracy; electronic voting; Mobile Communications; OWA operator.

INTRODUCTION

In December 2007, the e-Government Forum of the Organization of the American States (OAS) Electronic Bulletin (2007), evidenced the increasing quantities of unmarked ballots and electoral abstention in the electoral processes, which shows that many citizens do not perceive politics as a constructive dimension of civic identity, but as a ritual that is almost alien to them.

The International Institute for Democracy and Electoral Assistance (International IDEA) (2002) in the report Voter Turnout Since 1945, a Global Report, warns that public participation rate worldwide has fallen from 68% in the 1980s to 64% after 1990, and according to data recorded from 2000, this participation continues to decline. This demonstrates that the apathy towards participating in the elections reflects a growing gap between citizens and the political class that governs them.

Figure 1: Citizen Participation in Elections Worldwide



Source: International IDEA. (2002). International Institute for Democracy and Electoral Assistance. Voter Turnout Since 1945

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According to Moreno Jiménez (2005), currently the use of new technologies has led to the emergence of new patterns of human relationships, for example through virtual communities and social networks that use the Internet as a means of communication. According to the International IDEA (2002), this fact is encouraging researchers, sociologists, politicians, and citizens from different parts of the world to question the traditional methods of citizen participation, arguing that they have not adapted to the technological and social changes, new ways of achieving the government of the people and participatory approaches are subject to debate, using new technologies.

In these studies about citizen participation, according to Peláez (2008) two essential aspects could be established for the new models of participatory democracy to be initially considered as valid. The first one would be referred to the way of participation, which must involve the whole population, so the system should be easy and safe to use. Besides, it should be available to the greatest number of citizens, so that they can give their opinions or preferences about the projects to be carried out. And the second one, referred to how to weigh those preferences to achieve a result that reflects the views of citizens, taking into account that this fact should be independent of the values of the alternatives but dependent of the occupied position. This ensures that any voting process will weigh the alternatives up equally, regardless

of the preferences expressed by the citizens, achieving two goals: equality of all votes; and a sort of filter for stakeholders as it ponders the position and not the preferences.

Different researchers have attempted to respond to the above conditions in a global or local way. For example, Moreno Jiménez, Polasek`s (2004) propose a comprehensive solution of participatory democracy through a model that combines direct participatory democracy with representative democracy, called the e-cognocracy, which is complemented with the use of electronic voting via the Internet. To carry out this process, the Analytic Hierarchy Process (Analytic Hierarchy Process: AHP) is used, so that the hierarchy of decision criteria of choice and possible alternatives are set up by rulers, and the citizens establish their preferences in a single-round vote, using the Internet.

However, this method has a problem: the participatory practice is conducted in a mature technological society where all citizens use the Internet as a daily resource, they find out and learn through the network, and they vote electronically; so that the practice of this type of democracy is limited to a very specific social stratum and can exclude the society in general. In addition, the use of AHP would imply that citizens express their preference by comparison between pairs of alternatives, and due to the number of judgments to be issued, it will be necessary to have a computer or devices which are not available for the entire population.

The second aspect to consider method as a valid one refers to the weighing of alternatives. Yager (1988) defined the so-called Ordered Weighted Averaging Operators (OWA), which were designed to perform the weighting of the position, regardless of content. These operators are applied in many areas such as neural networks, fuzzy logic controllers, vision systems, expert systems and multi-criteria decision support systems.

This paper proposes a new model of civic participation that making use of mobile phones and OWA operators, meet the two key aspects for a citizen participation system to be considered valid.

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DEVELOPMENT

Participatory Budget

Implementation of the concept of participatory budget is one of the contexts where successful experiences of participation took place, an idea that emerged in the city of Porto Alegre (Brazil) in 1989 and is being replicated with increasing frequency worldwide. This concept can be simplified in the following idea: The city administration, rather than deciding how to execute all the projects, divide the city into zones, a percentage of its annual budget is assigned to each zone, and calls the neighbors to be themselves the ones who determine which projects the city should invest in with public money.

From the study of several practical experiences about Participative Budget documented by the Fedozzi (2002) and Martin Prieto (2006) it is concluded that the procedure generally takes place in three stages: in the first one, local assemblies take place, where neighbors are trained in project formulation; and in the second one, the projects are made up with ideas contributed by the neighbors, and they are selected by neighbors through voting according to their priorities. In the third stage, projects are (approved) passed and run by municipal authorities. It can be deduced from the three stages that the second one is the most important because it is where the neighbors make and vote the projects to be implemented by the local council.

According to the analysis of the implementation of different participatory budgeting, it was found that the project priorities are set by the political class in a subjective way and not by the opinions expressed by citizens or neighbors. Facing this reality, it is desirable that these priorities are determined by citizens themselves through their preferences.

The m-cognocracy.

The general definitions of what is the Electronic Government limit it to the providing public services to citizens using the Information and Communications Technologies (ICTs). This

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definition approached by Heeks (2004) and extended later by Brys (2005), although it is the simplest, it is the most popular. If we analyze the evolution of the Internet, you can see that the web has become interactive and focused on user involvement in a concept called Web 2.0, a name proposed by O'Reilly (2005), and where connections become more and more wireless.

Kurtz (2005) in his thesis about the Information Society, highlighted that people with ability to participate in decision making have become more engaged, better informed, more analytical, less submissive and are much more demanding with their political administrations. Nowadays, young people handle more communication and technological resources than the political class that governs them. There was a generation gap in the ability to manage knowledge. According to Inglehart (1999),it is a fact that in spite of maintaining their support for democracy; citizens have an increasing disrespect for authority.

Slaton, Arthur's (2004) suggest the existence of a seemingly contradictory situation. The numbers reflect a perceived lack of motivation and desire to participate in a traditional way, but the experiences in which the citizen can see himself as an active element through its direct participation in public affairs, show high levels of satisfaction and the desire to participate more often in making decisions that will affect his future.

These facts are not ignored by politicians, who feel that something is happening to the people, and suggest that improving public participation processes is a way to legitimize their mandate. But this is not an easy task, simply because they do not know how to do it. In these circumstances, governments must adapt to technological change adopting new methods for making decisions and reconsider other alternatives to exercise democracy.

To define this new emerging paradigm, this paper introduces the use of the term m-cognocracy, a model of participatory democracy where the e-citizens build in consensus knowledge to make community proposals, participate in government making decisions and deciding on the best of the alternatives by voting at the time and place of their choice through mobile communication devices in an electronic and at the same time remote way.

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To illustrate this new model of participation, how the construction of knowledge is carried out will be shown, and the technological paradigm and the methodology of counting the votes will be presented.

Electronic Voting

One of many possible definitions to explain the concept of electronic voting is developed by Alejandro Prince, where he expresses that:

> It is the application of devices and information and telecommunications technology systems to the act of voting; total or partially, to the entire electoral process or to some of the different activities of voting, registration and verification of the voter's identity, including the voting itself in an electronic ballot box (with or without immediate printing of ballot paper for citizen or authority control), the counting on the table or the consolidated global, the transmission of results, or other activities. [Prince, A., 2006, p. 9][1].

However, it is also raised the fact that the e-voting should not be just a change of tools that changes from a wooden box, into a metal box and a software, but rather it should be thought of as an opportunity to redesign completely the electoral system.

In the context of this research, we propose the use of mobile communication devices, such as cell phones as means of casting votes in a remote electronic voting, which receives the expression of popular will in the form of a text message.

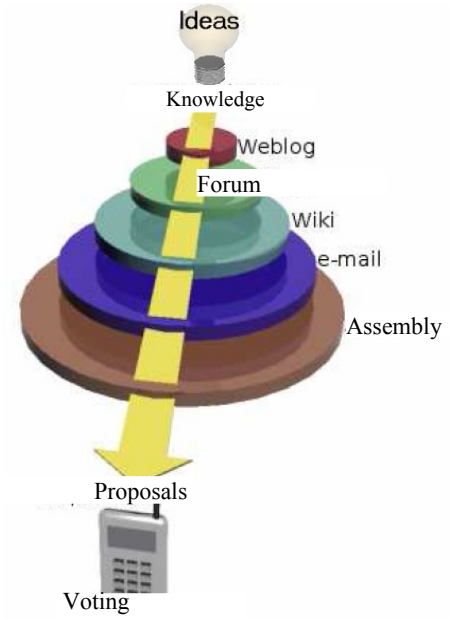
Knowledge Construction

In the technologycal context proposed by the present paper, the knowledge needed in the process of social decision making is built from an initial group of e-citizens with skills in handling several technological and communications resources that capture a set of ideas and turn them into popular initiatives. These ideas are discussed and enriched as they pass through several increasingly massive communication media with a greater participation and range, as shown in Figure 2.

In short, in the practice of m-cognocracy a few people start to join the call using social networks to raise awareness of initiatives in a blog. Others take these ideas to the forums and a proposal is built in a wiki. The proposal is sent to nearly everybody by an e-mail from an electronic newsletter. Everyone participates in neighborhood assemblies to discuss the

alternatives. Finally, they all vote using the Short Message Service (SMS) from their mobile devices to determine which the best proposals are and to obtain the order of priority of the projects that better represent the interests of the group.

Figure 2: Process of Knowledge Construction



Source: own

Technology Paradigm

The development of ICT has created a technological context where access to communication through mobile devices is global and universal. The most common communication resource among the population is the mobile phone, a resource which is exploited through SMS.

According to the company Informa Telecoms and Media, with an annual growth of 18%, the cell phone penetration is close to 50% of the world population. In 2009 the penetration will be of 60%, and in 2012 it will reach 66%. Currently, approximately a 10% of the world population has no access to a mobile network.

Kushchu, Kuscu (2003) and Ling (2003) suggest that these facts determine a technological paradigm where means of communication which is mostly used by citizen are the cell phones; therefore, it is not wrong to think that services are developed on a base of mobile

technology. This means that eventually people can perform their citizen duties and rights using a mobile device.

Penetration of mobile technology

The International Telecommunication Union reported that the total number of mobile users worldwide in late 2006 was about 2,700 million and the number of Internet users was around 1,100 million. This means that at least 23.6% of the world population (and at least 22.2% of the population of developing countries) already have mobile phones, but they are not using the Internet yet, as published by World Bank, The World Bank (2007).

The National Institute of Statistics and Census, INDEC (2007) estimated that in Argentina, 8 out of 10 people have a cell phone, and it has determined that there are in total 35 million mobile phones in service and that each person sends eleven messages a day on average, which represents about 215 million text messages per day, although according to the ICT Centre of Prince & Cooke (2007) Technological Indicators Argentina, in 2007 the number of mobile lines in use was 27.5 million, over 9 million fixed lines, amounts above the 13 million of Internet users.

According to the Society Information Indicator (SII), developed by the consultant Everis with IESE Business School, Everis / IESE (2007), in late 2007 in Argentina there were 904 handsets every one thousand people, therefore mobile technology in Argentina had the highest annual increase of the SII within the region which ranks it as the country which has best progressed in the development of the Information Society.

From these numbers, and considering that in Argentina there are approximately 26 million people in a position to exercise their right to citizenship, we can infer that cell phone coverage to citizens is close to 100%.

The amounts clearly show that the technological resource more available to the population currently are the cellular telephony, and it is a resource exploited by SMS messages.

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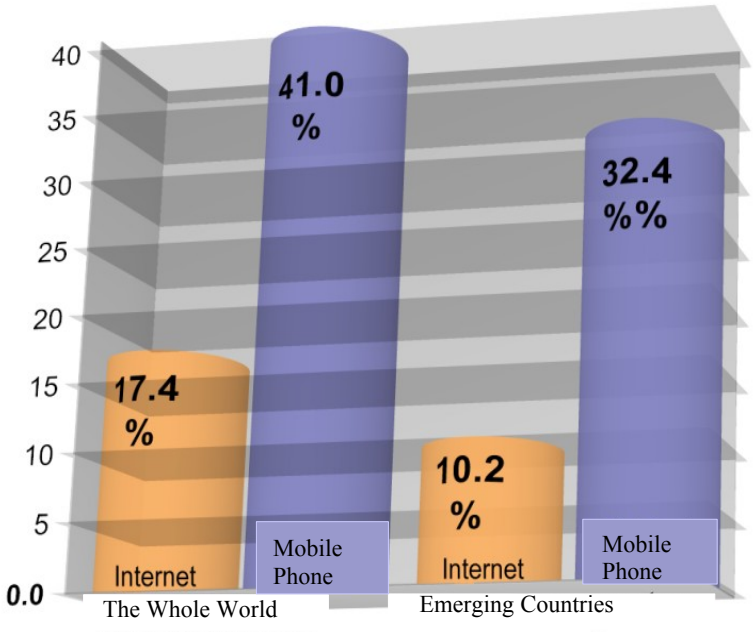
These facts determine a technological paradigm where the means of communication between citizens are cell phones and it is not the Internet, as can be seen in Figure 3.

Figure 3: Penetration of Mobile Technology



Source: International Telecommunication Union (ITU) – 2006

Mobile Government

A New Service Paradigm

Whereas many applications of government services using ICT are still incipient, it highlights the need for innovation in public management models, rethinking mobile telephony as a more effective and affordable alternative.

Information Technologies and Communications are the way to build a state at the service of society. The challenge is to consolidate a smart and dynamic state; able to operate efficiently where it is required to act, as expressed by the Ministry of Public Management (SGP) (2007). Building a fairer and more developed society, demands a government that has modern technology, with clear objectives and effective coordination between government areas. The Province of Misiones is moving on in these directions, involving with this project in a new paradigm of public service called Mobile Government or m-government.

According to Song, Cornford's (2006), the convergence of mobile communications and mobile computing technologies opens new horizons for mobile interaction. The use of this technology in the government sector not only provides an alternative channel of communication and public service, but also leads to the mobility of government itself and thus transcends the traditional model of service delivery of the Electronic Government.

Many services that were designed to meet the objectives of electronic government, today can be delivered by the new alternative channels provided by ICTs. Mobile services have emerged as the new frontier in transforming government and making it even more accessible and remote the delivery of information and services to those unable or unwilling to access public services through the Internet or simply prefer to use mobile devices.

Mobile technology takes electronic services and makes them available though mobile communication devices such as cell phones and PDAs (Personal Digital Assistants), without the need for traditional physical networks. The Government Mobile is a tool that complements the Electronic Government within the G2C/C2G relationship model and exploiting alternative channels of communication.

The m-government can be defined as:

> A strategy that involves the use of all types of wireless and mobile technologies, services, applications and devices to improve benefits for the involved parties in e-Government including citizens, businesses companies and all government agencies. [Translated by: Kushchu, Kuscu's, 2003, p.3][2].

Arazy (2002) defines the m-Government as a new discipline in relation to the growth of advanced mobile and wireless communication technologies to improve the quality of services offered by public administration to citizens. Despite being in its early stages of maturity, the m-government has a considerable influence on the generation of the strategies and tools for e-government, therefore: m-government is inevitable.

Widening the activities to wireless devices the governments can be more proactive in its operations, providing real-time services and giving citizens a wider range of interaction options.

Giddens (1999) and Urry (2000) reveal that the m-government implementations are emerging as a new value-added feature for the integrated and flexible data communication. The world and our society are increasingly recognized as nomadic or mobile society.

M-Government Services

The Short Message Service (SMS) is, without doubt, the flagship application of the mobile communication network. A study by Galperin, Mariscal's (2007) shows that 90% of mobile phone users in Argentina use this service.

From the government point of view, the setting to develop mobile-based services is still a virgin land, despite the technological sophistication that have reached their users and the availability of application development tools that are available. So, there are areas that can be benefited very quickly by the implementation of mobile services such as: public safety, firefighting, education system, the health care system, transport, exercise of democracy, etc.

Election Computing

As indicated above the second aspect to be considered as a valid method refers to the weighting of the choices, it is desirable that the weighting is independent of the values of the alternatives and dependent on the occupied position. This ensures that any voting process will weigh the alternatives equally, regardless of the preferences expressed by citizens, thereby achieving two goals: first, equality of all votes, and second, a sort of filter for all stakeholders as it ponders the position and not the values.

Borda's Voting Method

The method of choice in order of merit proposed by Jean-Charles de Borda in 1781, is a voting method that obtains a single winner, in which voters rank the candidates in order of preference.

Due to the fact that sometimes the candidates chosen are the ones who are in general terms acceptable, and not the majority favourites, the Borda's method is often described as an electoral system based on consensus, unlike the simple plurality system.

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In the Borda's method, each voter ranks the candidates according to preference. In the recount, if there are n candidates, the candidate receives n points for each selection in the first place, n - 1 point for every selection in second place, n - 2 points for each in third place, and so on until 1 point for every pick in last place. The candidate with the highest number of weighted votes is declared the winner.

As Borda's model:

$$Z_i = \sum w_i \cdot v_{ij}, (i = 1, \ldots, n)$$

where: $w_i = (n - i + 1), (i = 1, \ldots, n)$

Kendall's Adaptation

Kendall's solution proposed in 1962, coincides with the Borda's method, but it determines that the sum of the elements of vector management is standardized.

Often, this method is referred to as Borda-Kendall Method (BK) and, due to its simplicity, it is the most common method for obtaining a consensus arrangement.

As the Borda-Kendall model:

$$Z_i = \sum w_i \cdot v_{ij}, (i = 1, \ldots, n)$$

where: $w_i \in [0,1] \;\; y \;\; \sum w_i = 1$ $\qquad$ $w_i = \frac{2 \cdot (n - i + 1)}{n \cdot (n + 1)}, i = 1, \ldots, n$

The OWA Aggregation Operators

To carry out the weighing of voting results in this paper we use the OWA aggregation operator with the Borda-Kendall method proposed by Cook, Seiford's (1982) for determining the weights of the operator.

An OWA operator is defined as a function of dimension n F: $\Re$ n $\rightarrow$ $\Re$ that has an associated weight vector $W = [w_1, \ldots, w_n]^T$ where $w_i \in [0,1] \;\; y \;\; \sum w_i = 1$ to add a list of values $(p1, \ldots, pn)$.

In addition, $F(p_1, \ldots, p_n) = \sum w_i \cdot b_i = 1$

where b_i is the i-th largest value of p_n .

The weights of vector W are obtained using the Borda-Kendall method, so that:

$$w_i = \frac{2 \cdot (n - i + 1)}{n \cdot (n + 1)}, i = 1, \ldots, n$$

Therefore, the operator would be defined as follows:

$$Z_i = \sum w_i \cdot v_{ij}, (i = 1, \ldots, n) \qquad \text{(Formula 1)}$$

So that: v_{ij} is the absolute frequency of voters that put alternative j at position i in the ranking $(i = 1, \ldots, n)$, and wi is the relative weight of importance for the place i in the ranking. The total counting of each project Zi is an aggregate utility that is defined as a linear function of the relative weights of importance. Once the weights are determined in the exploration phase the projects are sorted according to their total scores.

In the model proposed in the Formula 1, the weights are related to the positions of the ranking and not to the order of the votes.

Example

A group of 20 residents of a neighborhood has drawn up a list of projects A, B, C, D, E, F that the local council will finance with its budget. The neighbors must choose which are the most important projects for the neighborhood, and each one votes using their cell phone with the following procedure: send SMS text identifying the projects in order of preference. Table 1 shows the result of the vote along with the absolute frequencies of the order of preferences for each project.

Table 1: Votes Received for Project A-F

Project	1st	2nd	3rd	4th
A	3	3	4	3
B	4	5	5	2
C	6	2	3	2
D	6	2	2	6
E	0	4	3	4
F	1	4	3	3

Source:own

The weight vector obtained using the Borda-Kendall method is:

$$W=(0.4,0.3,0.2,0.1)$$

Applying the equation of aggregation with the weight vector W we obtain the aggregate values for each project, as can be seen in the table below.

Table 2: Values for AF Projects Using OWA Weights Vector

Project	1st	2nd	3rd	4th	Total
A	0,12	0,9	0,8	0,3	3,2
B	0,16	0,15	0,1	0,2	5,26
C	0,24	0,6	0,6	0,2	3,8
D	0,24	0,6	0,4	0,6	4
E	0	0,12	0,6	0,4	2,2
F	0,4	0,12	0,6	0,3	2,5

Source: own

Ordering the total column that expresses the aggregate values of each project the following list: is obtained

B> D> C> A> F> E

If we compare the values of both tables we can see that if implemented the method of choice for a single project by a simple majority (Column 1, Table 1), projects C and D would have been winners with equal importance (6 votes). But this method does not consider the

different magnitudes of preference that may have the neighbors over other projects. However, using the aggregation method with OWA weight vector, the magnitudes of preference for all projects are included, and results that project B is the most representative of the interests of the citizens group.

Innovation Model

The innovation model focuses on the interaction method used by the citizen to participate in making decisions of local government, using mobile phones. The added value that shows the model is that the citizen has the ability to mark by means of an order the different proposals and projects presented by the residents themselves.

A relevant aspect is that the model of electronic voting by SMS may evolve into a voting model using the Wireless Access Protocol Wireless Access Protocol (WAP). Using the ability to surf the mobile Internet allows citizens to interact with the voting system.

CONCLUSIONS

This research paper presented a new way of citizen participation called m-cognocracy which, making use of mobile communication technology, and the OWA aggregation operators provides a new model for citizen participation in cities government. For this purpose, a way of building the knowledge needed for decision-making using ICTs has been presented, the technological paradigm that is based on the use of mobile phones and the use of SMS has been highlighted, the security scheme that allows using digital signature to cast the votes from mobile communication devices has been raised, a new alternative way of weighing which weighs the position, using OWA operators has been proposed, together with a new way to determine the weights of the operators using the Borda-Kendall's method.

Finally we have compared this new way of weighing with other methods and it has been shown how this way of weight the position and not the content, taking into account all the votes

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in all magnitudes of preference and this method of counting votes is more representative of the interests of all voters.

In this paper, the suggested e-voting system is based on the penetration rate of the communication resource (cell phone) and the most widely used service (SMS). However, technological developments are making smarter phones available to the people, such as phones of third-and fourth-generation (3G, 4G and SmartPhones), with the ability to download and run programs from the network.

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Please refer to articles Spanish bibliography.