

Elections and Technology

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Technology Systems and Elections

Over the past 20 years, electoral administrators have readily adopted two main types of technology into the electoral process: database systems (to support voter registration systems) and geographical information systems (GIS, for re-districting and logistics planning). It should be noted that, while they have brought great benefits in efficiency and effectiveness to the electoral process, these earlier technology adoptions were drawn from other fields, where the technology had been thoroughly and rigorously developed and tested. In comparison, the emerging field of electronic voting (e-voting) is new and exists primarily within the field of public and private electoral administration.

In a fully electronic voting system, voter identification, voting, the counting of votes and the transmission of data would all be performed by electronic and digital equipment without human processing. As yet, no country has achieved this level of modernization at the national level of election administration. However, systems that combine the use of manual processes and electronic technology (hybrid systems) offer a wide range of solutions, several of which have been used in a number of countries. The combination of these manual and electronic processes into a suitable hybrid system is influenced by a wide range of factors, and may arguably be considered unique in any given country.

One basis on which to compare the degree of automation of different systems is the 'trusted code base' (TCB). The TCB refers to the amount of computer code that is necessary to support a particular system. Simply put, the larger the code base that is required to support a system, the more complex it is and the more vulnerable to accidental or intentional manipulation. The 'trusted' aspect of this computer code refers to the degree to which it has been rigorously tested and accepted as accurate and correct.

Internet-based systems – those connected to the World Wide Web – raise significant security and technology-related concerns. Security issues relate to the exposure of the system to an unknown threat environment with similarly unknown threat capabilities. This environment includes not only national actors but also, by virtue of the online environment, foreign governments and hackers. Internet-based systems have the largest code base requirements. Moreover, as these systems communicate over the Internet travelling through public routers, certain parts of the code base cannot be considered trusted.

The two main types of technology being introduced in the polling activity of elections are direct recording electronic (DRE) systems and optical scanning technologies.

DREs are systems that allow voters to input their vote directly into the system, normally via a touch screen or keypad device, and the votes are automatically tabulated. These systems can also incorporate a sub-system to integrate directly with a voter registration card that has a unique identifier built in, for example, on a magnetic strip or a code that can be manually entered via a keypad. DRE systems normally have a requirement for a medium-to-high code base.

Optical scanning technologies relate to the scanning of ballot papers, where a voter's choices are indicated by a circle, oval or rectangle being filled in, in pen or pencil, on a standard printed ballot paper. These systems are not unique to electoral administration and are commonly called 'bubble forms' (due to circles being regularly used), which are used in several countries for national student examinations involving multiple choice questions. The TCB requirements for optical scanning technology systems are usually small in comparison to other solutions.

Electronic Voting

There are several challenges for an EMB that is assessing the benefits of introducing electronic voting. At the outset, these challenges include securing the resources necessary to effectively control and manage the evaluation and/or development process, as well as a clear mandate from government for one body to be solely responsible for the management of the process. This latter feature has become increasingly prominent, as competition among private-sector vendors of e-voting technologies has led to aggressive methods to introduce their products into new markets.

Depending on the circumstances in the particular country, electronic voting can require corresponding amendments in a number of areas (several of which may be outside the sole purview of the EMB), including the electoral law; the laws governing the rules of evidence (how evidence may be presented before a judicial body); investigative capacities; regulations and procedures for dispute resolution; the structure, staffing and core competences of the electoral authorities; the voter registration process; the candidate/party registration process; the training of electoral officials; the regulations for electoral observers; and the tabulation and announcement of results. Moreover, it necessitates dedicated programmes of consultation (with political parties and civil society) and a broad process of voter education.

Accordingly, the introduction of e-voting is normally viewed as a major reform to the electoral process. Where it has been introduced successfully, this has been done as a gradual process, with a pilot programme and phased adoption over several elections, allowing candidates/parties, voters and the electoral authorities to adapt to the new technology. This gradual approach allows for modifications to be made progressively and for the process to be halted if unforeseen difficulties arise.

There are many claims associated with electronic voting, such as that it increases voter turnout or improves security. However, there are few statistical studies of the impact of these systems on the electoral process and on corresponding political practices. Moreover, there is little evidence at this time to support claims that a particular technology will have the same impact in one country as it does in another. Thus, as with the process of electoral reform in general, the value and benefit of e-voting should be measured against the unique circumstances in which it is being proposed.

In general terms, electronic voting is associated with the following benefits:

- Symbolically, e-voting can be associated with the degree of modernity of a country.
- It allows multiple ballot ‘papers’ to be available at a polling site while avoiding regular logistical difficulties.
- It can make it impossible for voters to spoil their ballot ‘paper’ and to cast a spoiled ballot paper (a ballot that is not valid), whether accidentally or intentionally.
- It can permit photographs of candidates to be included on the ballot ‘paper’ at minimal cost (which assists with voters whose levels of literacy are low).
- It allows for the rapid tabulation of votes, which can be available within minutes of the closing of the polls.
- It can remove the possibility of some types of human error or fraud associated with manual voting processes.
- It can give illiterate or disabled voters more independence in casting their vote.

Main Issues

System Evaluation or System Development

A fundamental decision for electoral administrators is whether to seek a ready-made e-voting solution or to pursue the development of a customized system. A ready-made system that is adopted, by definition, will require changes in the electoral process to incorporate the system. In contrast, a customized system will more readily fit into the electoral process. However, customized system development is a more lengthy process and poses extra challenges in managing the development process, as opposed to the simpler evaluation process.

Since the 2000 presidential elections in the USA there has been a rapid expansion in the development of ready-made electronic voting systems by private vendors. This was further stimulated by the subsequent Help America Vote Act (HAVA), which made around 3.8 billion US dollars (USD) of federal funding available for the upgrading of US voting technologies. These systems of various configurations are generally offered to electoral authorities as ‘off-the-shelf’ hardware solutions. However, they can be customized to a certain degree by modifications to the software that operates these systems.

In contrast, Brazil’s national adoption of e-voting evolved over several years and was a customized development, where the federal electoral authorities defined specific and extensive requirements. Supported by other specialized areas of government, the electoral authorities then issued a call for proposals from the private sector to design and produce an electronic voting machine. A successful bidder for the contract to produce the machines was then selected through a competitive process of testing and analysis.

Total Cost of Operation

One of the main claims offered in support of introducing electronic voting is that of cost-effectiveness. However, traditional system developments in the computing field suggest that the initial capital investment to purchase a system can be as low as 25 per cent of the cost of the system over its expected lifetime. Subsequent costs that must be considered are those of voter education campaigns, maintenance, repair, secure warehousing, reprogramming, upgrading, staff recruitment and retention, audit and verification, temporary polling staff training and equipment replacement. Also – specific to the nature of the e-voting solution selected and its expected lifetime of use – it must remain secure in the face of other technological advances.

This can impose a lifetime limitation on certain technologies, estimated at 10 to 12 years, after which a new system may need to be installed.

Security

A central discussion within the electronic voting debate is the issue of security and its vulnerability in the presence of computer code, as outlined above in the discussion on the trusted code base. It is strongly recommended that the electoral authorities have ownership (complete access and control) over the source code for any e-voting machinery they employ. This usually involves two main code bases: the operating system (which runs the machine) and the application software (which is the program being used). To ensure that this requirement is met, the operating system is usually an open source operating system, such as BeOS or Linux. Other operating systems that are not open to inspection and customization for copyright reasons cannot be considered 'trusted' in this context.

The automation of polling processes by the incorporation of technology can mitigate certain types of security threat, such as certain types of tampering by polling staff. However, it is recognized that, while removing vulnerability to some types of fraud, technology creates new vulnerabilities. This is a heightened concern when the system is networked and centralized. In these cases, vulnerability to internal fraud is greatly increased and the impact of that fraud can be drastic. The introduction of technology may therefore require new 'check and balance' procedures to be introduced within the internal administration of the EMB.

Audit and Verification

To ensure that electronic voting equipment has the confidence of the electorate, a process of visible audit is normally required. Audit processes may occur prior to, during and after the polling event of an election. The means by which the audit is undertaken is a key decision for the EMB. Ultimately, the goal of the audit process is to assure the EMB itself, political contenders and voters that the system is accurate and secure. In some countries, electoral authorities or vendors have placed their source code for a system on the Internet so that anyone who wishes can assess the reliability of the software. Several options exist for these purposes, including one or more of the following:

- the EMB maintaining an internal unit for the purpose of audits;
- involving a trusted third party, such as a multilateral international organization;
- using an independent contractor, contracted for the purpose of audit;
- using open verification, where the system is made accessible to political parties, electoral observers and civil society to test and audit the operation of the system; and/or
- using another governmental institution to provide an auditing function.

In conjunction with the audit process there is the ongoing concern of the difficulty of verifying the tabulation done by a DRE voting system. Without a paper trail, if a failure occurs or allegations of manipulation arise, most DRE systems do not provide a means by which to verify the result. This concern is at the heart of the 'paper trail' debate that surrounds electronic voting. One approach to this issue is that the DRE produces a paper receipt for the voter that is placed in a regular ballot box. In the short term this may be a desirable confidence-building measure; however, in the longer term, it may be argued that under this scenario the machine has

simply replaced a pen – at much greater expense. Other approaches have sought to incorporate three or more independent tabulation systems, built in to the design of the system. These three independent tabulations can then be compared at the end of polling. Moreover, regular polling procedures may also be applied, such as the exclusion of a machine's results from the final election count if it is challenged and the challenge is not resolved, followed by re-polling at a later time.

Dispute Resolution

A major impact of introducing electronic voting systems is the impact on existing electoral dispute mechanisms. The challenges that arise in this context are the securing of evidence and the mechanisms by which disputes are to be evaluated and resolved. In some countries, where electoral disputes are handled by the judicial system, these matters may be subject to special provisions, requiring legislative amendments. Also, to investigate these matters effectively may require specially trained personnel within the EMB or the national law enforcement agency. At the outset, the existing rules of evidence pertaining to electronic or digital evidence should be reviewed to assess the need for special measures or amendments.

Interconnection with the Electoral Register

The collaboration between an electronic voting system and the means by which a voter's identity is verified is a core concern in assessing the suitability of a technology solution. As noted above, most e-voting systems are a hybrid combination of manual and automatic processes. In many cases, the process of voter identification is still a manual activity. To integrate the two systems normally requires that technological upgrades be made to the voter registration system, so that it 'interlocks' with the e-voting system. Also, a major factor in the integration of these processes is whether a voter is allocated to a specific polling place to cast a vote.

Transmission of Polling Results

In any secure communication system, information to be transmitted should be sent via three different media, for example, via the Internet (as an encrypted message), by facsimile transmission and by hand. If any information is changed during transit over any one medium, when it is reconciled with the other two transmissions, any error can be readily detected and resolved. A benefit of e-voting systems is that the tabulation from an electronic system is already in a digital form. Thus it can be easily transmitted over the Internet, printed as a pre-formatted facsimile and, if available as removable media, physically transported.

Contracting of External Service Providers

In considering the introduction of electronic voting technologies an EMB must determine whether the system will be maintained internally, depend upon other government authorities or rely on external service providers for certain services. If a decision is made to internalize the process this can require significant changes to the structure, staffing and functions of the

electoral authority. One of the main concerns in this area is the recruitment and retention of skilled staff who may later be sought after by private-sector vendors after they have gained experience and training in the implementation of such systems. If external service providers are used, contracts should be clear on actions to be taken if the company goes bankrupt, seeks to increase the cost of its services or is bought by a competitor. Also, if appropriate, contracts should stipulate that the company provides training to electoral officials for the ongoing maintenance and operation of the systems adopted.

Transparency and Electoral Observation

One impact of adopting electronic voting solutions is the lack of transparency associated with the polling exercise for electoral observers. Without invasive techniques, the process can become opaque for electoral observer groups, which may cause criticisms of the process. This issue may be addressed by allowing electoral observer groups to conduct independent audits of the e-voting systems prior to polling and after polling. Alternatively, electoral observer groups may be provided with independent audit reports as outlined above in the subsection on audit and verification. In some countries, this transparency concern has been a principal argument for retaining manual systems.

The 'Digital Divide'

Technology can be strongly associated with several social divisions. Usually, the adoption of technology is associated with demographic groups that are urban-based, wealthy and young. Through day-to-day exposure to various technologies these demographic groups are considered more conversant and comfortable with electronic voting solutions. In some circumstances, this association can lead to allegations that e-voting will disproportionately benefit those political parties that are supported by technology-literate constituencies. While there are few or no available studies to prove this correlation, political parties may raise the issue and allege that there is an intentional bias behind the proposal to introduce the technology. In part this concern may be addressed by ensuring that intense voter education campaigns are designed and implemented to familiarize all voting demographic groups with the technology. In some countries this has been done by using e-voting machines for private elections held for sporting or social clubs.

Recommendations

As in any electoral reform process, the introduction of electronic voting should be considered a sensitive exercise and the adoption of these systems should be subject to full processes of political and civil consultation and consensus building. The uniqueness of each country's electoral process means that in determining the appropriate solution the political, historical, cultural and religious factors that shape its elections must be considered. In these circumstances, the determination of an appropriate technology solution cannot be addressed in isolation and must be judged in terms of its impact on the overall credibility of the electoral process.

To this end, a clear and unambiguous definition of the problems that e-voting will attempt to address is necessary. Once defined, the specifications of a system should be outlined that will resolve the problems identified. Following the specification process, the range of solutions that

might be available can be considered through a vendor demonstration event. In this scenario, producers of e-voting systems can be invited to demonstrate their solutions to the electoral authorities, political parties and civil society representatives. It is important that these events be conducted with a pre-established set of benchmarks upon which to evaluate the suitability of the demonstrated systems. On the basis of these events, the electoral authorities can determine whether to adopt a ready-made solution, pursue a fully customized system or reconsider the initiative.

It is recommended that:

- Any solution adopted should try to meet the requirements with the smallest necessary TCB.
- The EMB should be the owner of the source code for the system.
- Any system that is adopted should be assessed in terms of the projected total cost of operation of the system over an agreed lifetime of operation.
- The arrangements for the maintenance and operation of the system should ensure that the system can be cost-effectively sustained.
- The process of adopting this form of technology should be undertaken in a planned, gradual way.

Conclusion

The ultimate test of any electoral process is the confidence and acceptance of the electorate and political competitors that it will provide a fair and accurate result. Sufficient resources and a clear mandate for the EMB to manage and control this process are essential. Furthermore, experience has shown that the process by which these systems are incorporated into the electoral administration and socialized is as significant as the technology itself for achieving the successful adoption of these systems into the electoral process.