

SUPPORT TO ELECTORAL
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ELECTRONIC VOTING MACHINES: THE PROMISE AND PERILS OF A NEW TECHNOLOGY

SUMMARY

The introduction of electronic voting machines (EVMs) to conduct elections is a major step for any country. Benefits can include the inhibition of polling-station fraud, as well as improved accuracy and speed of counting and results transmission. EVMs are often perceived as a modern tool of governance.

At the same time, EVMs are expensive and have multiple associated risks. These relate to limited transparency and therefore confidence in the process and outcome of an election. EVMs also create opportunities for manipulation and are accompanied by the risk of malfunction; e.g., as a result of faulty storage or use.

Switching to EVMs is by no means a purely technical measure. Rather, it is an important public policy choice. As such, there must be full disclosure of information about EVMs, along with broad and informed public debate before they are introduced.

Public confidence is a key requirement for successful elections because without widespread trust results may be rejected. Lack of trust in an electoral process can be exacerbated by the use of new technology, which many voters can find difficult to understand. Lack of confidence in the electoral process is a critical problem for any democracy, in particular in situations where there is a high risk of conflict and disaffection.

Decisions on EVMs should be taken with extreme care. While they offer much promise, there are also many perils to be overcome.

1. INTRODUCTION

The use of technology for elections began over a century ago with mechanical voting machines. These evolved into a variety of electro-mechanical systems, including the punched card vote tabulation machines made infamous in the US presidential elections in 2000. In rare cases there is now internet voting, which gives voters freedom to cast their ballot from a location of their choice.¹

EVMs are a subset of available electronic voting technologies.² Their introduction has not followed the typical pattern in which technology is first taken up in the technologically-developed world, and then later adopted by less developed countries. Instead the trend appears to move in the opposite direction, whereby EVMs have been taken up in some poorer countries, but wealthier, more established democracies have often rejected their use. Among less developed countries, there is a tendency to use EVMs without sophisticated and costly transparency mechanisms, such as voter-verified paper audit trails (which give the voter a paper record of their vote choice).³

The following patterns of adopting the use of EVMs have emerged over time:

- Gradual introduction of e-voting

Some countries have slowly introduced EVMs, taking into account local context and capacities. Brazil is such a case and its EVM arrangements are considered to be successful. India also has taken a long-term, gradual approach, though scrutiny of EVM functioning is limited, both in terms of transparency of the EVMs and lack of access to observers. Use of EVMs in India is increasingly subject to criticism (see text box on page 4 below).

- Rapid introduction of EVMs

Other countries have introduced EVMs at a faster pace. Paraguay, for example, moved quickly from pilots in 2001 to binding implementation during the 2003 presidential elections, when 53% of registered voters used EVMs.⁴

- Decisions not to introduce EVMs

While most established and new democracies have decided not to use EVMs, some have tried them and then ultimately decided against their use. Others have decertified the systems in use, while not rejecting EVMs in principle. This includes Germany, the Netherlands, the UK, Finland and Ireland (see text box on page 4 below).

¹ Estonia was the first country in the world to introduce nationwide, binding internet voting, which was piloted in 2005. In 2007, Estonia piloted internet voting for its parliamentary elections and offered all voters the internet option for the March 2011 parliamentary elections. See: <http://www.ega.ee/?lang=en>. Several cantons of Switzerland also allow Internet or SMS voting. See: <http://www.geneve.ch/evoting/english/welcome.asp>.

² The wider group of electronic voting technologies is often known as 'electronic voting' or 'e-voting'. This includes internet voting and SMS voting.

³ Voter-verified paper audit trails give the voter sight of a paper record of their vote choice, enabling him/her to check that the EVM has correctly recorded their choice. However in situations where voters are at risk of intimidation, pressure and vote-buying, giving a paper record to the voter can perpetuate such negative electoral practices because they enable a voter to demonstrate their voting choice outside the polling station.

⁴ Paraguay returned to the use of paper ballots in 2008. See: Alvarez R., Katz, G., Pomares J., "Evaluating New Voting Technologies in Latin America", CALTECH/MIT Voting Technology Project, December 2009, at <http://vote.caltech.edu/drupal/node/323>.

This range of approaches to EVMs demonstrates that their introduction is neither an indication of the technological prowess of a country, nor is it a testament to the democratic nature of their elections.

2. THE PROMISE

The introduction of electronic voting (also known as 'e-voting') is usually driven by one or a combination of the following factors: anticipated cost savings, fraud reduction, increased accuracy and speed of results tabulation, voting anywhere in a constituency, improved accessibility for voters with disabilities and for remote/overseas communities, and the lure of new technology. While e-voting can provide such opportunities, there are many other related factors that must be taken into consideration.

Reduced Cost

Elections are expensive undertakings and the use of EVMs appear to offer savings, in particular by eliminating the costs of printing and distribution of ballot papers, many of which are wasted, especially where voter turnout is low.

However additional costs can be incurred for storage, support and security of EVMs, over and above the initial and significant capital required to purchase the machines. These expenses can be particularly burdensome in countries with difficult climatic and geographical conditions and where there are higher levels of insecurity. EVMs may only last through a limited number of election cycles—sometimes as few as two—and then they need to be replaced.

One important additional cost of EVMs is for Voter Verified Paper Audit Trails (VVPATs). These are a vital measure to ensure transparency because they provide voters with an opportunity to view a paper record of their vote. As such, they can feel greater confidence that their ballot choice has been correctly recorded.

Mitigating Fraud

The use of EVMs is frequently offered as a defence against ballot stuffing and alteration of results by biased or intimidated poll workers. For example, to inhibit such insider fraud, the EVMs in India limit the number of votes that can be cast per hour to a level that is consistent with the actual possible number of voters that can be processed in an hour.

At the same time, EVMs will not counter all types of fraud as poll workers are still responsible for the polling station, for example, checking that there is no intimidation, ensuring that polling opens and closes on time and, critically, ensuring that only legitimate voters use the EVM (and use it just one time). With most EVMs, poll workers are still required to identify a voter and decide if s/he may cast a ballot. Furthermore EVMs open up the possibility of other, more sophisticated types of fraud through manipulation of the software and hardware.

Increased Accuracy and Speed of Results Tabulation

EVMs can provide almost instant counting and delivery of results at the polling station. The transmission of results from polling stations to aggregation centres also can take place more rapidly and possibly more securely than with

paper-based systems. A quick counting, transmission and aggregation of results can reduce the scope for fraud and avoid the political instability of a drawn-out process.

However, these advantages are only effective if there is sufficient transparency for people to be able to see the veracity of the aggregated totals. This requires transparency of polling station results so that the aggregated total can be checked. With first-generation EVMs there is no paper record to physically check and count. Later model EVMs, equipped with VVPAT may provide the voter with an opportunity to view the paper trail, but also may offer limited or no transparency of the count at the polling station. Some EVM designs include a VVPAT that allows for a manual recount by collecting the printed ballots.⁵

Regardless of the architecture, EVMs require independent testing of all software, as well as the communication system used to consolidate polling station results, to know that each vote is being correctly recorded and aggregated.

Voting Anywhere in a Constituency

There is often a belief that use of EVMs will allow registrants to vote in any polling station they choose in a constituency, making it much easier for people to cast their ballot and increasing voter turnout. This possibility requires EVMs to be on a network. Such networking shows if someone has voted already somewhere else in the constituency, thereby stopping the same person voting again at another polling station. Without a network, multiple voting by the same person is a potential risk.

In reality, up until now e-voting anywhere in a constituency has only been possible in Estonia because internet voting was used. Even there voters had a full choice about casting their vote on the internet or by the traditional paper method.

Internet voting is vulnerable to failures of the network, hacking, voter confusion, and loss of voter privacy (and therefore secrecy of the ballot).

The Lure of New Technology

Some countries use the introduction of electronic voting technologies as a means to energise electorates and encourage greater participation in the democratic process. Young people, in particular, are believed to be more likely to vote if they can do so using EVMs. E-voting also may be perceived as increasing or boosting the democratic credentials of a country.

At present, it is not clear that EVMs will lead to increased participation, and their use may actually put some voters off due to lack of familiarity with the machines and possible mistrust in the system and the election management body. Election observers have criticised many elections that were held with EVMs, so there is no obvious link to more genuine elections. Consequently,

critics are often concerned that the introduction of EVMs wastes public funds.

3. THE PERILS

There are various other issues and risks that should be addressed so that prudent decisions can be made about the introduction of any electronic voting system. These are particularly important as the ramifications of an ineffective introduction of EVMs are not just financial waste and inefficiency, but are more serious. That is, an entire election process can be called into question, bringing with it all of the consequences that may have in terms of political instability and violence.

Assuming EVMs are Silver Bullets

The greatest danger with EVMs is the mistaken assumption that they will solve all of the problems that plague elections. Who is permitted to vote remains dependent on the election administrators who are managing the EVMs. The use of EVMs cannot avert the capture of entire polling stations by partisan persons, for example, nor can they stop the destruction of equipment to prevent voting by supporters of opponents.

Similarly EVMs will not prevent intimidation, vote buying, media bias, low participation by women, the abuse of state resources by incumbent parties or endemic political and electoral violence. On the contrary, because of their enormous financial costs and the changes involved with their use, the introduction of EVMs could divert energies and funds from addressing these fundamental issues.

Loss of Transparency

Transparency is essential in an election process. Unless stakeholders can see that the process is being conducted correctly and that results are being accurately aggregated, it is difficult to have confidence in the results and outcome. Transparency in EVMs is extremely difficult, requiring training and technical know-how.

Elections also require high levels of confidentiality so that the choice of each voter remains secret. The defining challenge in the design of EVMs is to reconcile the competing requirements of transparency of the process and the secrecy of the vote. Any electronic voting system that offers both the required transparency and confidentiality is likely to be so complex as to be beyond the comprehension of all but a tiny minority of IT experts. As such, the rest of the population must trust the judgment of the technical elite.

In this vein, the German Federal Constitutional Court ruled in a landmark decision in 2009 that 'the use of electronic voting machines requires that the essential steps of the voting and of the determination of the result can be examined by the citizen reliably and *without any specialist knowledge of the subject*' (emphasis added).⁶ The Court

⁵ The count may still be conducted by the EVM—thus lacking transparency—with the retained paper ballots only used in the event of a technical problem with the automated system, where the EVM in question has been randomly chosen for a manual count or where an electoral dispute has arisen.

⁶ See <http://www.bundesverfassungsgericht.de/pressmitteilungen/bvg09-019en.html>.

indicated that the constitution requires that 'all essential steps of an election are subject to the possibility of public scrutiny unless other constitutional interests justify an exception'.⁷ As a result, the use of EVMs has been stopped in Germany.

The lack of transparency of any piece of technology in the election process can result in suspicion on the part of stakeholders. This is particularly important when results are widely at variance with expectations. The lack of transparency with EVMs for polling and the count inhibits effective observation by political party agents and accredited election observers, which is an essential component of an election.

The Problem of Trust

Trust and confidence in the electoral process is an essential prerequisite to election results and outcomes being accepted. It is notoriously difficult to build trust in EVMs, as their operations are not easy to scrutinise. The machines also have limitations and can be misused. Hence the introduction of EVMs is often only recommended once there is proven enduring trust in the system. The Council of Europe handbook on e-voting states that, 'it has become clear that e-voting systems cannot be introduced unless citizens trust their political and administrative systems'.⁸

Where there is a lack of trust in the institutions operating or certifying EVMs, or the manufacturers from whom the equipment is purchased, it will be difficult to establish stakeholder confidence in the electoral process and outcome. EVMs are computers, which run software. All software carries the risk of malfunction or manipulation. Any analysis of risk must weigh two important parameters. First, what is the likelihood of the risk or threat occurring and second, what is the impact should that risk materialize. Some of the risks to electronic voting systems may be highly unlikely, but their impact may be severe.

The challenge of establishing and maintaining trust in electronic voting systems is exacerbated by issues of ownership and control. This becomes more critical when the nature of the technology employed to automate elections is proprietary, rather than being open in nature.⁹ Critical questions arise such as who really runs an election when the software is a secret (e.g., because of intellectual property rights of the manufacturer)? And does the use of proprietary software mean a derogation of duty by elections management bodies?

⁷ *Ibid*

⁸ *E-voting Handbook: key steps in the implementation of e-enabled elections*, Council of Europe, 2010, page 8. See: http://www.coe.int/t/dgap/democracy/activities/ggis/E-voting/E-voting%202010/Biennial_Nov_meeting/ID10322%20GBR%206948%20Evoting%20handbook%20A5%20HD.pdf.

⁹ For more on this topic, see the articles on open source referenced at: http://en.wikipedia.org/wiki/Proprietary_software.

Ireland: Abandoning EVMs

Why did Ireland, a once wealthy, literate, high-technology economy decide to abandon its EVMs mere months before their planned use in nationwide elections in 2004?

The answer is that key stakeholders, including opposition political parties, civil society and many citizens, simply lost trust and confidence in the procured 'solution'. The commission established to look into the matter concluded:

...that it is not in a position to recommend with the requisite degree of confidence the use of the chosen system at elections in Ireland in June 2004... The Commission wishes to emphasise that its conclusion is not based on any finding that the system will not work, but on the finding that it has not been proven at this time to the satisfaction of the Commission that it will work.¹

Finland: Vote Re-Run after EVM failure

In 2008, Finland piloted the use of EVMs in three municipalities (with traditional paper balloting also allowed). Acting on a complaint, the Supreme Administrative Court cancelled the results in the three municipalities because of flaws in the procedures and instructions in the use of EVMs, and ordered new elections to be held. The government later decided to stop the use of EVMs.²

India: Confidence in EVMs

The Election Commission of India has repeatedly and publicly affirmed its "...faith in the infallibility of the EVMs. These are fully tamperproof, as ever".³ Expressed in August 2009, that confidence was eroded when, just months later, an academic study by Indian and international experts demonstrated specific vulnerabilities and problems with the use of the Indian EVM. The study concluded that:

...despite elaborate safeguards, India's EVMs are vulnerable to serious attacks. Dishonest insiders or other criminals with physical access to the machines at any time before ballots are counted can insert malicious hardware that can steal votes for the lifetime of the machines. Attackers with physical access between voting and counting can arbitrarily change vote totals and can learn which candidate each voter selected.The design of India's EVMs relies entirely on the physical security of the machines and the integrity of election insiders.⁴

¹ Interim Report, the Commission on Electronic Voting, April 2004, page 7. See: <http://www.cev.ie/htm/report/V02.pdf>.

² Finland Parliamentary Elections, OSCE/ODIHR Needs Assessment Mission Report, January 2011. See: <http://www.osce.org/odihr/75599>.

³ Press Note, Election Commission of India, 8 August 2009, page 2. See: http://eci.gov.in/eci_main/press/current/pn080809.pdf.

⁴ "Security Analysis of India's Electronic Voting Machines", Prasad, et al, Proceedings of the 17th ACM conference on computer and communications security, October 2010, page 20. See: http://indiaevm.org/evm_tr2010-jul29.pdf.

4. EVM USE IS A PUBLIC POLICY ISSUE

The introduction of EVMs is a major step in the electoral arrangements of a country. This is not merely a technical question, but a major decision of public policy because the use of EVMs is costly and involves high levels of risk. As such, their use needs to be carefully considered and made subject to public debate and deliberation.

Such a major policy decision should not be left to the discretion of the election administration, but instead should be subject to broad consultation and the legislative process. A broader advisory body, perhaps along the lines of the Irish Commission on Electronic Voting, might be constituted whose recommendations would inform both the legislative and technical processes.

Consultation must allow ample and meaningful opportunity for all stakeholders to achieve sufficient understanding of both the issues and the technology. This is a major challenge given the capacity constraints under which many stakeholders operate and also the complexity of the issues surrounding EVMs.

Questions to address in a public policy process include:

- Which problems does use of EVMs try to address and are these priority issues of electoral reform?
- What would the realistic financial cost be of purchasing, maintaining using and storing EVMs?
- How feasible/practical are the EVMs given the country's conditions (i.e., geographic, climatic, infrastructure, security, educational levels, IT skills levels, etc.)
- What is the cost/benefit ratio of introducing electronic voting?
- Do stakeholders, such as political parties and voters, trust the election administration?
- Do stakeholders trust the information technology?
- What are the risks of introducing EVMs?
- What other means are there for addressing electoral problems?
- What benchmarks and milestones should be reached before any nationwide deployment of any EVMs?

The enthusiasm that often characterises the early phases of efforts to introduce EVMs should not deflect stakeholders from learning more about the issues and the technology. Manufacturers (vendors) with commercial interests in the uptake of EVMs can be persuasive, but they are not impartial. Technology companies are essential partners for election administrations and nations as they begin to explore the use of electronic voting systems. But this exploration should not be vendor-led or technology-centric.

5. CONCLUSION

EVMs can bring improvements to the running of elections. These include the suppression of some forms of fraud

(carried out by individuals, usually at a polling station level) and increases in the accuracy and speed with which results can be counted and transmitted. However these potential benefits can come at a high price in terms of loss of transparency and confidence in the process. Such losses can have severe consequences, especially in the cases of close or disputed elections. Cost savings are rarely found when EVMs are introduced.

Technology improves at a rapid pace and more and more solutions to the challenges of voting by EVM emerge. There also can be strong stakeholder demand for demonstrable improvements in the running of elections, making EVMs particularly appealing. Policy discussion based on full information, research and consultation is therefore essential. Any further actions should be taken in measured steps (e.g., through pilot testing) and with genuine stakeholder agreement.

Should there be a policy decision to introduce EVMs, then various steps and principles should be considered:

- The broad consultations that should characterise the debate on introducing EVMs also should take place during implementation, where stakeholders and election assistance implementers must participate in the process.
- Start small with feasibility tests, pilot tests and local development of infrastructure.
- Ensure that the necessary changes in the legal and/or procedural framework are made.
- When purchasing, consider (amongst other things): training needs, storage requirements, electricity requirements, back up support provision, proprietor coding issues, transparency measures, ability to audit and so on.
- Provide for required staffing and ensure there is full training, including opportunity for practice.
- Undertake a public information campaign.
- Provide adequate time. It has been estimated that four to eight years are required from the time of the policy decision to the full roll-out of technologies.
- Do not test or initiate new technology during a major election.
- Do not introduce technology to compensate for poor procedures.

Experience has shown that the introduction of EVMs has been problematic and complex. Apparent benefits have often been out-weighted by the loss of transparency and confidence in the system. Where there is little or no trust in the election process or in the institutions tasked with running elections, the introduction of EVMs becomes a much higher risk endeavour. The costs to a nation, and the risks involved in a disputed election process, should be carefully considered by a broad range of stakeholders before making a decision on using EVMs.

RESOURCES

The following is a collection of online resources that offer further insight into this subject. The bibliography

contained in the handbook at Reference 6, and the extensive list of resources on Dr. Mercuri's webpage at Reference 10 below are both useful additional starting points for further research.

1. "From Power Outages To Paper Trails: Experiences In Incorporating Technology Into The Election Process", GEO Conference paper, Applied Research Centre, IFES, 2007. Available at: www.ifes.org
2. "E-voting: an Immature Technology in a Critical Context", PhD thesis, Margaret McGaley, Department of Computer Science, National University of Ireland, Maynooth, September 2008. Available at: <http://www.cs.nuim.ie/~mmcgalley/index.shtml>
3. "Ireland: A Decade of Electronic Voting" in *Direct Democracy: Progress and Pitfalls of Election Technology*, Michael Yard (editor), Direct Democracy Series, IFES, 2010. Available at: www.ifes.org
4. "Committee on the Use of Electronic Voting Machines in Pakistan: Final Report and Recommendations", Election Commission of Pakistan, September 2010. Available at: www.ecp.gov.pk
5. "Voting System Failures: A Database Solution", Lawrence Norden, Brennan Center for Justice, NYU School of Law, 2010. Available at: www.brennancenter.org
6. "E-voting Handbook: key steps in the implementation of e-enabled elections", Council of Europe, November 2010. Available at: <http://book.coe.int>
7. Various conference proceedings, Competence Center for Electronic Voting and Participation. Available at: www.e-voting.cc
8. "Electronic Vote Tabulation: Checks & Balances", PhD thesis, Rebecca Mercuri, University of Pennsylvania, 2001. Available at: <http://www.cis.upenn.edu/grad/documents/mercuri-r.pdf>
9. Reports of the Commission on Electronic Voting, Ireland, 2004-2006. Available at: www.cev.ie
10. Electronic Voting – a web resource by Dr. Rebecca Mercuri. Available at: <http://www.notablessoftware.com/evote.html>
11. *Direct Democracy: Progress and Pitfalls of Election Technology*, Michael Yard (editor), IFES, 2010. Available at: www.ifes.org

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DRI has an 18-month grant from the European Union to work with Pakistani legislatures (federal and provincial) on promoting electoral reform as a follow-up to the 2008 EU Election Observation Mission. The grant also includes work with the media to improve coverage of electoral reform and local elections, as well as assessments of the local elections.

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