ELECTION TECHNOLOGY SERIES

Direct Democracy:

Progress and Pitfalls of Election Technology

Michael Yard
Editor

INTERNATIONAL FOUNDATION FOR ELECTORAL SYSTEMS
IFES
SINCE 1987

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September 2010

Direct Democracy: Progress and Pitfalls of Election Technology, Michael Yard

IFES
1850 K St, NW
Fifth Floor
Washington, D.C. 20006
U.S.A.

Printed in United States of America
ISBN: 1-931459-51-7

ACKNOWLEDGEMENTS

This publication represents the efforts and contributions of a large number of people. It would not have been possible to complete this project without the dedicated support of IFES professionals in Washington, DC, and internationally.

The project was made possible by the F. Clifton White Applied Research Center for Democracy and Elections (ARC). Specific thanks are due to ARC Director Rakesh Sharma and research staff, Gabrielle Bardall and Hani Zainulbhai, as well as Bella Desai and Theresa Yu Chen, of IFES' Communication and Advocacy Division. Gabrielle has been integrally involved in the project from the beginning and has provided immeasurable guidance in establishing the framework, selecting the case studies, contacting writers, and giving patient but consistent reminders of looming deadlines.

Thanks are due to the case study writers who generously shared their insight and unique experiences in these pages and to Staffan Darnolf and Ben Goldsmith for their reviews and invaluable recommendations.

I would like to personally thank my wife, Laura Brodrick, for her loving support through the past 16 years of working internationally, which has resulted in many missed family holidays and late nights at the computer when I am home.

Finally, I would like to acknowledge the late Joe C. Baxter, a pioneer in international election assistance, as well as a mentor and friend, from whom I learned most of what I know about election administration and whose passion for promoting democratic integrity was contagious.

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ACRONYMS

AFIS	Automated Fingerprint Identification System
BM	Ballot Module
CEC	Central Election Commission
CEV	Commission on Electronic Voting
CoEC	Community Electoral Commission
CoE	The Council of Europe
CPP	Convention's People's Party
DPD	Regional Representative Council
DPR	Dewan Perwakilan Rakyat (People's Representative Council)
DPRD	Provincial Level People's Representative Council
DPRD/K	Regency and Municipality level People's Representative Council
DRE	Direct Recording Electronic Systems
ECK	Election Commission of Kenya
EMB	Election Management Body
GAO	U.S. Government Accounting Office
GECOM	Guyana Elections Commission
GPRS	General Packet Radio Service
GSM	Global System for Mobile
ICR	Intelligent Character Recognition
ICT	Information and Communication Technologies
IES	Integrated Election Software
KPU	Komisi Pemilihan Umum (General Elections Commission, Indonesia)
MERC	Media Election Results Center
NEC	National Electoral Commission
OMR	Optical Mark Recognitition Scanners
OSCE	Organization for Security and Cooperation in Europe
PPRC	Political Parties Registration Commission (Sierra Leone)
PR	Proportional Representation
PRU	Programming and Reading Unit
PVT	Parallel Vote Tabulation
REC	Regional Election Commission
SERIS	SMS Election Results Information System
SIM	Subscriber Identity Module
STV	Single Transferable Vote
TLM	Technology Lifecycle Management
VM	Voting Machine
VVPAT	Voter-Verified Paper Trail
VVSG	Voluntary Voting System Guidelines

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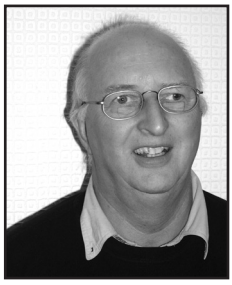

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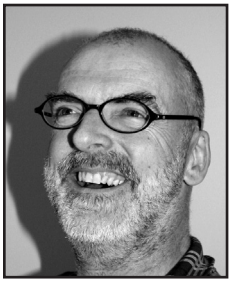

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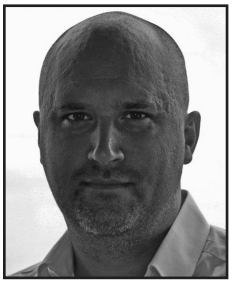

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Preface

Before beginning a discussion of the practical implications of election technology it is worth taking some time to acknowledge that this is not a new topic for discussion but one that has been carried on for centuries. Of course the specific technologies being considered will change with time but underlying principles of the discussion will transcend the debate over which biometric system is better or which digital voter registration kit is the most cost-effective The over-riding theme that should provide a foundation for any analysis of technology used in elections (or in any other field) is a discussion of basic principles, i.e. what is the essence of the electoral process and how will the tools that we choose enhance or detract from this essence?

There is growing consensus among election practitioners on a number of basic principles that should guide every electoral process. Although the list varies from one document to another, most agree, at a minimum, that all electoral processes should be accessible, secure, accountable, auditable, transparent, and sustainable.

In evaluating what technology to use in elections, these principles are especially important; otherwise, we may gain efficiency while sacrificing the fundamentals of a good election.

The marketing of technology has been so effective that there is a tendency in the early 21st century to equate technology with progress. For many, higher tech is synonymous with "better." On the other hand, resistance to change can lead to objections that any new technology is "worse" than the existing way of doing things. We are better equipped to evaluate the pros and cons of election technologies if we resist both of these tendencies. A new way of doing things should not be judged either as good or bad simply because it is new, but should instead be evaluated upon the basis of whether it helps to make elections more or less democratic given the resources, risks, and alternative solutions available.

The discussion of pros and cons of various types of technology and their relation to democratic process extends back at least as early as Greek mythology and the classical debate can offer pertinent insight for framing current discussions on the subject.

Plato and the Essence of Democracy

In the writings of Aeschylus, Prometheus is the mythological father of technology, appropriating for human beings the power of fire, numbers, the alphabet, medicine, the ability to navigate, etc.[1] But there is other knowledge, more directly related to democracy, as described by Plato:

Although man acquired in this way [through Prometheus] the wisdom [techne] of daily life, civic wisdom [politike techne] he had not, since this was in the possession of Zeus. Zeus therefore, fearing the total destruction of our race, sent Hermes to impart to men the qualities of respect for others and a sense of justice, so as to bring order into our cities and create a bond of friendship and union. Hermes asked Zeus in what manner he was to bestow these gifts on men. "Shall I distribute them as the arts were distributed--that is, on the principle that one trained doctor suffices for many laymen, and so with the other experts? Shall I distribute justice and respect for their fellows in this way, or to all alike?" "To all" said Zeus. "Let all have their share. There could never be cities if only a few shared in these virtues, as in the arts."[2]

In a few sentences Plato outlines a framework for examining the essence of the relationship between technology and democracy. Techne puts knowledge, power, and control into the hands of a few. In its best implementation, this power is used for the purpose of serving the many.

1 Aeschylus, *Prometheus Bound*, trans. Herbert Weir Smyth (Cambridge, MA.: Harvard University Press, 1988)

2 4. Cf. Plato, Protagoras, trans. W. R. M. Lamb (Cambridge, MA: Harvard University Press, 1967).

However, the basis for democracy is established in the proposition that the politike techne, the understanding of justice, mutual respect, and civic responsibility are shared equally by all. This basic principle should be preserved in all electoral processes. For elections to have credibility, it is important that the process be understood by all. An inherent risk in any marriage of elections and technology is that control may pass from the many to the few who have the special knowledge required to understand and evaluate whether there are adequate safeguards to ensure fairness and accuracy. Any approach that passes control from the many to an elite few – whether their elitism is by virtue of political power, social class, wealth or specialized knowledge – violates the very essence of democratic elections.

Martin Heidegger – Understanding the Essence of Technology
In the mid-20th century, Martin Heidegger revisited the philosophical didactic on the relationship between technology and democracy, insisting we cannot understand the essential issues surrounding technology by focusing only on technology:

The essence of technology is by no means anything technological . . .Thus we shall never experience our relationship to the essence of technology so long as we merely conceive and push forward the technological, put up with it, or evade it. Everywhere we remain unfree and chained to technology, whether we passionately affirm or deny it.[3]

Heidegger neatly summarizes the different stances with regard to technology – proponent (push forward), tolerant (put up with), opponent (evade) – and claims that none of these stances can help us to understand the essence of technology. To understand the essence of technology requires that we step outside the discussion of technology's pros and cons and examine the meaning of technology and its relation to the common good. In terms of election technology this leads us back to the essence of democracy – an election technology can only be judged good or bad in direct correlation to how well it advances or detracts from the essence of democracy, i.e. whether it evenly distributes kratos, control or rule, among all ***demos***, the people, or concentrates that control in a select few.

3 "The Question Concerning Technology", Martin Heidegger: Basic Writings, ed. David Farrell Krell, trans. William Lovitt, New York: Harper & Row, 1977

> *"Without doubt, many election management processes have been significantly improved through the application of technology."*

Heidegger goes further to analyze the nature of different approaches to technology. The Greek root techne is applied to any skill or craft, whether manufacturing of shoes, houses and machines, creation of art, music and poetry, or management of elections. For Heidegger, this skill or craftsmanship can be applied either for manipulation of our environment or for opening up and revealing of reality. The distinction is reflected in two fundamentally different approaches to technology. For Heidegger, "what is decisive in techne does not lie at all in making and manipulating nor in the using of means, but rather in the revealing." This is in contrast to a misuse of ***techne***, "which puts to nature the unreasonable demand that it supply energy which can be extracted and stored as such." To illustrate, he contrasts the example of a windmill that reveals, but does not extract and store the energy of the wind and a hydroelectric dam that transforms the meaning of a river into that which can provide energy. All other meanings of the river then become secondary and are obscured by this primary redefinition.

In this debate, there may not be a solid consensus on the comparative good of windmill vs. hydroelectric dam (though environmental sustainability has become a much more widely-held value over the past few decades, notwithstanding). But Heidegger's analysis points out an important difference between two approaches to technology that is important when evaluating technologies for use in democratic elections. One approach leans toward transparency, seeking to reveal the inner workings of the electoral process. This approach uses technology tools to allow greater scrutiny, inviting broader participation, and increasing the democratic-ness of elections. Another approach views electoral process as a stream of resources (time, money, information) and seeks to maximize the efficient use of those resources. This creates a fundamental dichotomy opposing transparency vs. efficiency that often comes into play when determining whether a technology is appropriate for elections. This is not to say the efficiency in elections is, in itself, a bad thing; on the contrary, it is only when efficiency comes into conflict with transparency that it becomes undemocratic.

Jacques Ellul on the Idolatry of Efficiency

The problem is that, for many, efficiency has become an overriding value that must be pursued regardless of cost. Theologian Jacques Ellul observed that "technology has become…the defining force of a new social order in which efficiency is no longer an option but a necessity imposed on all human activity."[4] Techne, which was originally a skill or craft, a means by which to create a result or product, has become an end in itself, and "the multiplicity of means is reduced to one: the most efficient."[5]

This idolatry of efficiency has led to a number of abuses in election management, ranging from gerrymandering of electoral delimitations to blind trust in voting systems that cannot be audited.

Efficiency or Transparency – a crucial choice for elections

Technology is well suited to solving problems of efficiency, and election management has no shortage of such problems. Without doubt, many election management processes have been significantly improved through the application of technology. Large-scale data entry, management of voter registration data, production of ballots, and logistical planning are examples of problems where application of technology has made major advances.

Technology can also solve problems of transparency. It is crucial when selecting appropriate technology to recognize that there are some electoral processes which demand that transparency have greater emphasis than efficiency. The application of appropriate technology for elections requires careful deliberation to determine when this is the case, followed by even more careful deliberation to decide whether there are tools that can help to promote transparency.

The implications of this philosophical distinction may have a major, far-reaching, and long-lasting impact upon the practice of democracy. One approach to technology focuses on centralized control, dependency upon a technological elite, and application of manufacturing principles of uniformity. In many domains, it is desirable to create "black box" components that focus on inputs and outputs and require no knowledge of the inner logic; such components lead to more efficient development and deployment. In conducting voting, counting, and tabulation, however, the "black box" approach is essentially undemocratic, taking power away from the many (election officials, party agents, observers, media), and putting into the hands of the few.

4 Ellul, J. The Technological Society. New York: Vintage Books, (1964 American edition; the French edition was published in 1954).

5 Ibid.

Key Guidelines and Principles

This study presents a number of case studies in an introduction of election technology. The cases were selected to represent environments with varying levels of infrastructure and technological literacy, and different stages of democratic development. Through analysis of these case studies we seek to determine whether the introduction of the particular technology led to a net positive or negative impact on the election process, and whether any positive impact provided improvements significant enough to justify the immediate and long-term costs.

We then look for any common factors that may help to provide "best case" guidelines for maximizing the chance of successful implementation of new technologies into election processes. Our goal is to provide Election Management Bodies (EMBs) and other critical stakeholders with information and data they can utilize to guide their decision-making on technology implementation. While this publication is not necessarily an exhaustive survey of technology implementation in the election process, it is a vital first step in providing guidelines based on commonly accepted principles used by electoral experts around the world.

Before discussing key guidelines and principles that should inform the adoption and implementation of technological solutions for the electoral process, it is instructive to outline some critical considerations that orient the thinking of electoral professionals when it comes to elections and

technology. These considerations are universal in nature in that they should inform decision-making at key junctures of the process. These considerations compel decision-makers to consider the timing, characteristic, management, and overall feasibility of technological solutions for the election process.

When to introduce new technology

One important, and nearly universal, guideline relates to appropriate timing for introduction of new technology. The concept of the electoral cycle (Figure 1) has been advanced by International IDEA and the European Commission to move the focus on planning for a single election to a focus on promoting sustainable election planning. There are a number of visual representations of the cycle, but all divide election planning into three distinct phases:

1. Pre-Electoral Period
2. Electoral Period
3. Post-Electoral Period

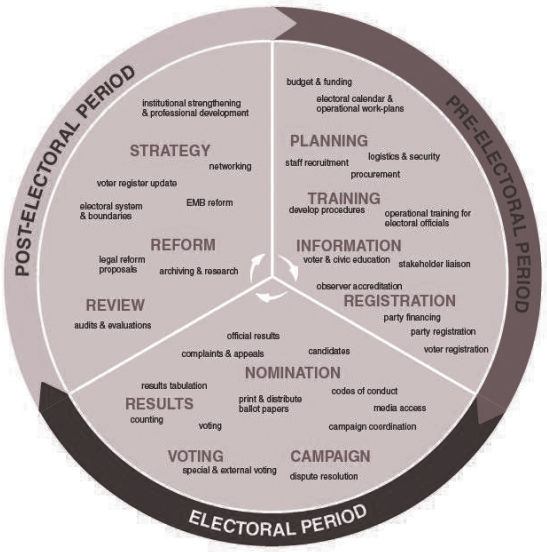


Figure 1 - The Electoral Cycle

Whenever possible, new technology should be introduced during the Post-Electoral Period. EMBs typically have fewer demands on their time during this period. By beginning during the Post-Electoral Period, the EMB has more time for feasibility studies, pilot projects, and modification of procedures and training; all of which are necessary to maximize the success of a new technology.

Planning for the Technology Life Cycle

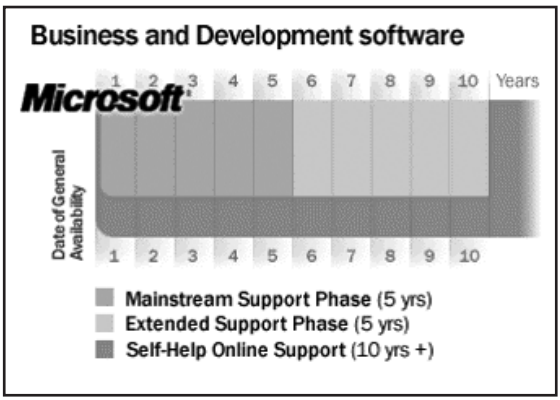


Figure 2 - Changes in the Windows Operating System

For at least 30 years businesses have planned technology infrastructure with an understanding that the cost of new technologies does not end with initial procurement. There are costs for deployment, training, maintenance, upgrades, and security. As well, all technologies have an anticipated life expectancy after which they become obsolete and require disposal. Technology Lifecycle Management has a number of implications for election technology planning.

With most countries conducting national elections on a four or five year cycle, it is important to recognize that anticipated life expectancy means that any new technology will be used for a limited number of elections.[6] A quick review of changes in the Windows operating system illustrates the speed with which technologies become obsolete and are replaced by newer technologies (Figure 2):

1985: Windows 1.0
1987: Windows 2.0
1990: Windows 3.0
1993: Windows NT 3.1
1996: Windows NT 4.0
2000: Windows 2000
2002: Windows XP
2006: Windows Vista
2009: Windows 7

6 A comparison of Technology Lifecycle and Election Cycle was presented by Peter Wolf, International IDEA, at EC-UNDP-IDEA Joint Thematic Workshop on The Use of Information and Communication Technologies in Electoral Processes in November 2009. We are indebted to him for introducing this concept as well as for the analysis of technology change since 1984.

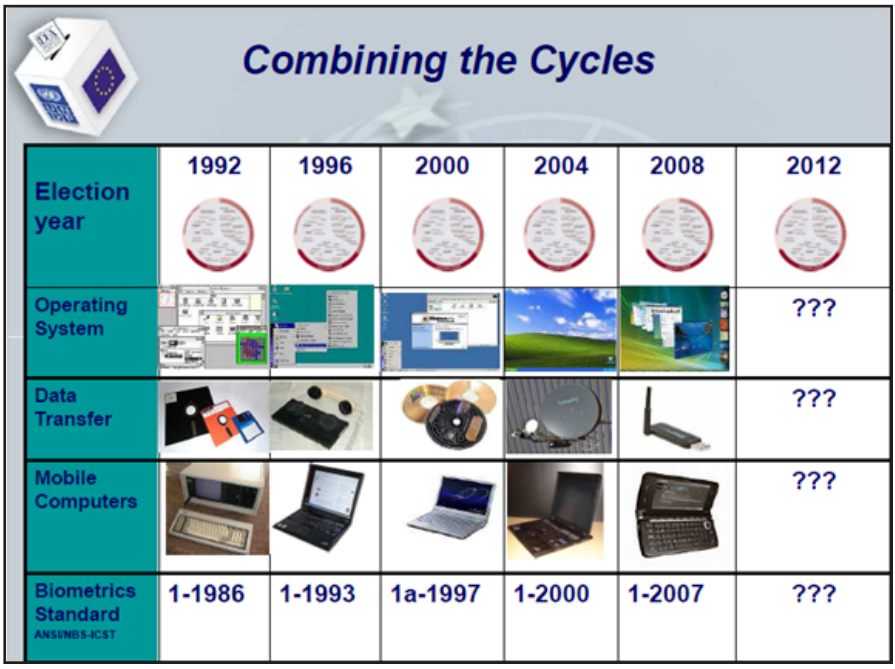


Figure 3 - Overlay of Election and Technology Timelines

This rapid evolution of the Windows operating system means that most computer systems from a decade ago, if still operational, are running on operating systems that Microsoft considers obsolete. The official policy of Microsoft is to provide mainstream support for five years, followed by extended support for five years. The difference is that "Microsoft will not accept requests for warranty support, design changes, or new features during the Extended Support Phase."[7]

These ongoing changes are not limited to the operating system. Since 1990, personal data storage devices have evolved from floppy disks, to CD-ROMs, DVDs, USB flash drives, and, now, online storage. Communication has gone from dial-up services to proprietary services such as Compuserve and America Online to the internet, with broadband data transmission via DSL, fiber optic, satellite, and mobile phone networks. Peter Wolf points out that even by relying on standards it is difficult to find any longer term stability; the ANSI standards for biometric systems has gone through four significant versions since 1993. Overlaying a technology timeline with an election timeline, Wolf produces the following graphic illustration of how much change occurs over a few election periods:

7 Microsoft Support Lifecycle website, http://support.microsoft.com/?LN=en-us&scid=fh%3Ben-us%3Blifecycle&x=14&y=11#Extended Support

Figure 3 illustrates that the decision-making process employed by EMBs should not only take into account technical considerations for the election cycle in which the technology is expected to be utilized, but long-term considerations related to technological evolution as well.

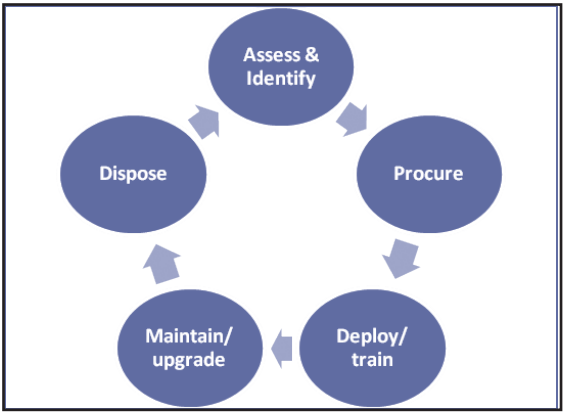


Figure 4 - Technology Lifecycle Management

Importance of Technology Lifecycle Management

Technology lifecycle management (TLM) takes a broad planning view over the design, procurement, deployment, management, and disposal of all elements in the organization's technology infrastructure, including security of data throughout the lifecycle. TLM can provide a realistic estimate of total cost of ownership, training needs, and deployment schedules – and can assist election administrators with the difficult task of coordinating introduction of technology within the election timeline. Equally important, TLM provides a tool for anticipating budgeting requirements necessary to ensure sustainability of the new technology.

The different stages involved in Technology Lifecycle Management include:

- Assessment and identification of organizational mission, objectives, and policies for determination of appropriate technology
- Procurement of technology, including feasibility studies, pilot projects, specifications, and vendor evaluations
- Deployment of systems and training of end users
- Maintenance, repair, and necessary upgrades, including ongoing helpdesk services and technical support
- Plan for proper disposal

- Security for all systems throughout the lifecycle, including provision of security for all data stored on any media at time of disposal

> *"Even the largest city on the islands was small enough that poll workers knew almost every voter who came to cast a ballot."*

This broad planning perspective can help to avoid rushing to implement new technologies during critical election periods, plan ahead for funding requirements, and anticipate staffing needs.

Criteria for determining appropriate technology

Nearly every discussion of technology and elections at some point includes reference to the concept of appropriate technology, often as a way of justifying application of a particular tool. Through overuse, the concept has been stretched nearly beyond recognition and used to support almost every imaginable approach to addressing election related issues. It seems that the concept of "appropriate technology" has become bendable enough that it can serve whatever purpose the user wants. *If I can get away with labeling my pet technology as "appropriate," then I've already won the battle – who can make an argument for "inappropriate technology?"*

One counterbalance against this elasticity of meaning is to go back to the origins of the concept. E.F. Schumacher is credited with initiating the discussion of appropriate technology in his book, *Small is Beautiful: Economics as if People Mattered.*[8] Schumacher criticized international development practices of the 1960s as an attempt to export models of management and technologies that may not have been appropriate for the countries they were being foisted upon. One example he gave was in agriculture, where industrialized nations tried to convince non-industrialized nations that it is preferable to import machinery that will allow a single farmer to manage crops on a thousand acres. Schumacher questions the impact upon the thousand farmers who had previously owned one acre each and were now unemployed. Hence, the title of his book counters the claim that bigger is better, that centralized is more efficient, that minimal human involvement is an advance over maximum human involvement.

8 E.F. Schumacher. "Small is Beautiful: Economics as if People Mattered." Blond and Briggs, Ltd. London. 1973.

There is a growing consensus in identifying which basic principles should be applied to all election processes; technological processes should not be exempt from these standards. A good starting list of standards for helping to determine "appropriateness" might include:

- *Accessible* – Process should enfranchise all eligible voters and be able to be operated and maintained without long-term outside assistance

- *Secure* – Should provide protection from unauthorized access and from excessive loss due to natural disaster or malice

- *Accountable* – Must ensure all recording and modification of data is done according to legal guidelines, with a clear record of who did what

- *Auditable* – Must include capability to independently verify that the output of the process is logically consistent with the input

- *Transparent* – Must provide for a clear understanding by stakeholders of how the technology works and implications for the election process

- *Sustainable* – can be repeated without depleting available resources

The considerations listed above are a useful checklist for decision-making on technology and elections. The next section will detail specific steps that election management bodies and other electoral stakeholders should take as they move forward in the introduction of technological solutions for the election process.

The Way Forward

There is a risk in trying to prescribe a one-size-fits-all methodology for implementing effective and sustainable technology; every country has a unique set of problems and cannot necessarily import the solution of another country. But there is even greater risk in introducing new election technologies without clear and careful methodology to ensure technology meets requirements. So, with the disclaimer that this is not a comprehensive list, and with an invitation for further refinement, we propose the following steps should be at least part of the way forward.

1. Identify the problem
This sounds like such an obvious first step, but countless projects have begun with a solution in mind before the problem is fully identified. One example illustrates the extent to which this happens. Many countries have at least considered introducing a biometric system as part of voter registration, and in many countries this type of technology can be a valuable election management tool. However, a specific technology should only be considered if there is a specific problem that the technology can address.

In 2009 there was a strong push in Fiji to include automated fingerprint identification as a requirement for every person on the voter list. Responses to the question of how this would improve voter registration were wide-ranging, with expectations that it could eliminate impersonation at the polling station, remove deceased persons from the voter register, and prevent registration by non-citizens and underage voters. None of these issues were addressed in any way by the proposed technology. A survey of political party members and field election staff indicated that there was very little concern about persons registering more than once, the one issue that the proposed system could help to address.

Identifying the problem is not always a simple exercise. Surprisingly, the aforementioned survey also indicated there was minimal concern about impersonation, deceased persons, underage voters or non-citizens. Even the largest city on the islands was small enough that poll workers knew almost every voter who came to cast a ballot. The biggest problem raised in stakeholder discussions was suspicion that some parties were bussing voters from polling station to polling station, allowing multiple voting – a suspicion that, according to most observers, was completely unfounded and was only used by losing parties to cast doubts on the legitimacy of the ruling party. So, the main problem was really a lack of trust, which could have been more effectively addressed by voter information, publicizing the controls that were already in place to prevent bussing in voters.

The problem identification step should be able to clearly identify a difference between what should be and what is. It should further include a clear understanding of why things should be the way they are envisioned. Without this clear understanding, there is a very real danger that any solution introduced will solve a wrong on nonexistent problem.

2. Invite broad discussion from stakeholders and implementers
Even if a real problem has been clearly identified and there is good, affordable, and easily available technology that can address the problem, it is still important to invite discussion from political parties, civil society, and electoral staff who will be responsible for implementing the solution. Often these discussions can provide valuable additional information about the scope of the problem and direction to effective implementation. At a minimum, discussions may be able to broaden acceptance of the final approach. If it is impossible to get endorsement from stakeholders and implementers there is a strong probability that the problem has not been adequately understood, and an even stronger probability that the solution will not be accepted.

3. Consider whether there is a need to modify the legal and/or procedural framework
Pakistan recently overhauled their voter register, including a sophisticated database management system to support the new system. There was wide acknowledgment that the old voter lists were inaccurate, in large part due to the fact that voter information was collected by uneducated and untrained canvassers going door-to-door. Problems cited included village chiefs who invited the canvasser to sit and have tea while he sent one of his associates to get data. Heads of household provided names of many more persons than were actually in the household and the canvasser dutifully listed every name mentioned without verifying the actual existence of the person. The common motivation behind these practices was to inflate the voter list in a way that gave the village a greater voice than what would have been allowed by an accurate listing of voters.[9]

The new system that introduced more than a million dollars (USD $) of hardware and software to manage the lists did nothing to change the way the data was initially collected; resulting in the same inaccurate data, now stored in the computer rather than on paper.

Effective technology often requires a change in procedures. A thorough "requirements analysis" process will address not only the tools needed, but also the systems and processes that must be reengineered in order to shape an effective solution.

9 "Toward Accurate and Credible Electoral Rolls," Report of Consultant on Computerized Electoral Register, UNDP Supporting Electoral Democratic Processes in Pakistan (SDEPP, Michael Yard, March 2005)

4. Provide for required staffing
One problem that confronts many EMBs, especially in developing nation contexts, is the difficulty of recruiting and retaining good, qualified technology staff. In order to compete with the private sector, EMBs should evaluate whether there is a significant disparity between their pay scales and those offered in the private sector. If so, it may be necessary to find ways to adjust the pay scale in order to be competitive. Otherwise, it will be difficult to recruit technology staff and retain trained staff due to temptations from outside offers of higher pay.

There are inducements beyond salary that can help to recruit and retain staff, and the EMBs that are most successful have been able to institute one or more of the following measures:

- Obtain a waiver from public service/civil service payment constraints for mission-critical elections IT personnel

- Provide opportunities for ICT personnel to travel overseas on secondment to international NGOs, UN, OSCE, other EMBs etc, and to be remunerated accordingly

- Allow lengthy leaves of absence for relevant study or personal development projects

- Seek joint funding support for IT salaries from international donors

If it is not possible to retain adequate in-house staff, the EMB should carefully consider whether there will be adequate funds to pay for continued support from external vendors, and whether fostering continuous dependency on external vendors is in the best interest of the EMB.

5. If possible, start small
Perhaps more than any other measure, a decision to start with small steps (see Sierra Leone case study for an example) and then incremental improvements can help avoid major failures in technology projects. Some initial steps that can help build a foundation include:

<u>Feasibility tests</u>
Whenever possible any new technology should be tested in small trials that involve representative samples of staff who will be required to use the technology and persons who will be affected by it. For example, before buying hundreds or thousands of cameras, it is a good idea to buy

two or three cameras, and then test them with field staff and "volunteer registrants." This step can help to identify whether the photos produced have high enough resolution and contrast, and whether the cameras are easy to use without extensive training. It is often helpful to allow observers to make notes on any problems or issues that may arise during this testing to guide a review of procedures and to help plan for training.

Pilot testing

A pilot test in two or three communities can provide valuable "lessons learned" that can be built into procedures and training manuals before rolling out a new system. In some cases, the pilot may reveal weaknesses that cannot be adequately addressed. Although this can be disappointing, it is still much better than discovering the same weakness after the system has been introduced on a large scale.

6. Build infrastructure

The cost of computers and communication networks continues to drop at a rapid pace. Providing adequate tools for staff both at headquarters and at field offices can have a major impact on the organization's ability to effectively manage elections. Over the past two decades, it is surprising how many EMBs have rolled out large, expensive systems for voter registration while staff responsible for accounting, logistical planning, supply and fleet management, and human resource management limp along with outdated computers and software, or worse, without any computer at all. Before focusing on large IT projects, the EMB should review its overall IT infrastructure.

7. Provide adequate time

Any project that must be implemented on an overly aggressive schedule is a project that has a very high risk of failure. If there is not adequate time to carefully define needs, then there is probably not enough time to do an effective job in implementing the technology. It is imperative to discuss possible solutions with stakeholders, conduct feasibility tests and pilots, reevaluate the approach repeatedly throughout the planning cycle and follow organizational regulations and procedures for procurement.

8. If you have never done it before, don't test it during a major election

This is related to the "start small" principle listed above. Elections should not be used as a testing ground for new, unproven technologies, nor as a place for election staff to get their first introduction to a technology. If you have never driven a car, you don't start on a high speed motorway; you start on an untraveled side road. How can

you expect to make a knowledgeable decision about a handwriting recognition system if you have never experienced one or with a biometric system if you have never taken a fingerprint or installed an automated fingerprint identification system (AFIS) software package? If no one within the EMB has any experience with a proposed technology it is especially important to start with a series of feasibility tests and pilots to gradually gain familiarity with the systems, resulting in the ability to guide a responsible decision-making process.

9. Do not introduce technology to compensate for poor procedures
One of the most important steps you can take to maximize the probability of a successful technology system is to first do everything possible to address the problem without resorting to technology. Once you have a sound legal framework, a good set of organization procedures, and well-trained staff, if the problem is not already solved, then you at least have the best possible basis for introducing technology. Bill Gates said it clearly, "Automation applied to an efficient operation will magnify the efficiency. Automation applied to an inefficient operation will magnify the chaos."

The Common Sense Test
Many of the recommended steps, listed above, fall under a general use of common sense. Yet the number of failed or marginally successful election technology projects is an indication that common sense has failed to serve as a guide. Before buying a new car, a new watch, even a new jacket, most of us run through a set of questions in our minds. Does it meet my needs? Does it fit? Can I really afford it? Is it easy and relatively inexpensive to maintain? Can I have it delivered by the time I need it? Will it last long enough to justify the price? If the answer is no, then common sense dictates that this is not an effective, appropriate, or sustainable purchase. By exercising just this much discretion when planning for implementing election technology, this common sense test would significantly improve EMBs' chances of implementing effective, appropriate, and sustainable technology.

Results Compilation and Transmission

Discussions of results publication often get bogged down in misunderstanding of terminologies, even among election officials. In order to avoid confusion, it is important to agree upon definitions.

- *Provisional or Preliminary results* – are results that are communicated more quickly than the flow of paper result forms. Most countries still require forms signed by an election official, and often party agents and/or observers at the polling station to certify that the results on the form are true and accurate. The flow of paper through the administrative hierarchy and the consolidation of these results take time. In order to keep the public informed on the progress, many countries have alternate methods for communicating preliminary or provisional results, which are released to the media while waiting for the paper flow to catch up. These results do not have any legal bearing upon who wins and loses the election but they do serve a valuable purpose in keeping the public informed. In very close contests and in countries where there are fears of cheating in the results tabulation process provisional results can also help to alleviate these fears by demonstrating that a careful counting process is going on, and that the process takes time.

- *Consolidation, tabulation, tallying, and canvassing* – are all terms applied to the process of adding up votes from the polling stations.

- *Progressive or Partial results* – refers to the release of vote count information as it comes in from the polling stations, as opposed to withholding all reporting until the results are consolidated. These can either be progressive or final.

- *Verified results* – are vote counts that have gone through a process of checking for accuracy in form-filling and/or data entry.

- *Legal or Final results* – are results that have gone through all legally required processes and are now binding.

- *Aggregated vs. Disaggregated results* – is related to the level of detail that is finally made publicly available, i.e. whether the results from polling stations are made available, or whether only the aggregated totals are published.

- *Parallel Vote Tabulation (PVT) and Quick Count* – are sometimes used interchangeably to refer to the use of sampling of a subset of the results to project results within a margin of statistical certainty. These exercises are usually carried out by civil society organizations, though occasionally are conducted by EMBs.

The Reporting Process: a Simple Theoretical Framework

Reporting of election results seems like a very straightforward task that ought to be based on a simple logical progression. Voters cast ballots, ballots are counted, counts are aggregated, and final counts are published. The final publication ought to look more or less like a financial accounting sheet with subtotals and totals, and with some form of double-entry accounting to ensure that the totals add up correctly. If reporting results does not give disaggregated data that allows participants to verify on a polling station by polling station basis and to verify totals, it requires a leap of faith to accept that the announced results correlate to the actual votes.

Yet, for some reason, reality does not always follow neat theoretical progression, and results publications sometimes jump straight to winner and loser, without showing enough detail for stakeholders to verify that the numbers add up. For example, while British election results have been published in detail since 1945,[10] Polish law prior to 2001 prohibited ublication of disaggregated results.[11] The failure to publish disaggregated results has been a main point of contention in Kenya in 2007[12] and in Zimbabwe in 2008.[13]

Anatomy of a Results Reporting System

In a typical results reporting scenario, the votes are counted at the polling station in the presence of observers and political agents. The presiding officer then fills out a form reporting the number of votes for each ballot choice (political party, candidate, referendum option, etc.), as well as giving an account for all ballots, those valid and invalid. Ballots become invalid for three primary reasons: (1) a ballot placed in the ballot box but was not counted, due to no preference expressed or some violation rendering it invalid, (2) a spoiled ballot occurs when the voter made a mistake marking it, so returned it and requested a new ballot, and (3) an unused ballot. This reporting form is then signed by the presiding officer and political agents.

The completed form is then sent to an elections office for a first level of consolidation. Depending on the country this may be at a constituency, district, region, or other administrative level. At this level, the numbers are transferred to a consolidation form or spreadsheet and added up. Depending on the size and administrative structure, this form may be passed up the hierarchy to another office that further consolidates the results. The following table[14] is an example of precinct level results for Pima County, Arizona, for the 2008 United States Presidential Election.

The results are combined with results from all 15 counties in the state.[15]

10 "British Governments and Elections", http://www.politicsresources.net/area/uk/uktable.htm

11 Antoni Sulek, "The Struggle for the Freedom to Publish Pre-Election Poll Results: The Case of Poland," International Journal of Public Opinion Research Advance Access published on May 7, 2008

12 Report of the Independent Review Commission on the General Elections held in Kenya on 27 December 2007, Judge Johann Kreigler, et al., http://www.dialoguekenya.org/report.aspx

13 "Zimbabwe court rejects demand to release election results", USA Today, April 14, 2008

14 Based upon Arizona Secretary of State website, http://www.azsos.gov/results/2008/general/counties/Pima_By_Precinct.txt, formatting by author

15 Pima County Elections Department website, http://www.pima.gov/elections/res1108.htm

Table 1 – Precinct Level Results for 2008 Presidential Election, Pima County, Arizona

	Precinct # (5 of 417)					Totals from 214 precincts
Candidate	1	2	3	4	5	
OBAMA	552	47	108	460	414	77428
McCAIN	564	47	23	167	813	71593
BARR	11	0	0	2	10	742
McKINNEY	4	2	2	0	1	243
NADER	13	4	1	2	3	752

Table 2 – Precinct level results are then consolidated into a county-level report and transmitted from Pima County to the State of Arizona.

Candidate	Party	Polls	Early	Provisional	Total	Pct
OBAMA	DEM	77428	119891	8935	206254	52.24%
McCAIN	REP	71593	102341	8472	182406	46.20%
BARR	LBT	742	1107	74	1923	0.49%
McKINNEY	GRN	243	411	29	683	0.17%
NADER	NON	752	1147	96	1995	0.51%
Write-in Votes		587	920	72	1579	0.40%

Table 3 – State of Arizona Consolidated Results – Presidential 2008

County	BARR LBT	McCAIN REP	McKINNEY GRN	NADER NONE	OBAMA DEM	Totals
Apache	111	8,551	75	109	15,390	24,262
Cochise	371	29,026	90	356	18,943	48,820
Coconino	267	22,186	117	309	31,433	54,344
Gila	150	14,095	31	156	7,884	22,333
Graham	60	8,376	23	56	3,487	12,007
Greenlee	16	1,712	3	17	1,165	2,913
La Paz	39	3,509	14	53	1,929	5,552
Maricopa	7,605	746,448	1,799	6,095	602,166	1,364,962
Mohave	433	44,333	111	561	22,092	67,605
Navajo	158	19,761	70	182	15,579	35,800
Pima	1,923	182,406	683	1,995	206,254	393,428
Pinal	530	59,421	116	562	44,254	104,883
Santa Cruz	49	4,518	17	35	8,683	13,303
Yavapai	638	61,192	185	638	36,889	99,648
Yuma	205	24,577	72	177	18,559	43,615
Totals	12,555	1,230,111	3,406	11,301		2,293,475
Pct.	0.50%	53.60%	0.10%	0.50%	45.10%	

This level of reporting allows maximum accountability as all stakeholders can confirm that the results reported from the polling station are accurate, and they are accurately consolidated at every level. Looking at this in reverse,[16] it is possible to start at the top level and see the total number of votes for a candidate, then "drill down" one level to see how many votes came from each state, down another level to see how many of those votes came from every county, and then finally down one more level to see the votes at the polling station (in Pima County, there is one polling station per precinct).

Making it secure and auditable

Although the reporting system described above provides a significant level of accountability and provides the ability for all stakeholders to verify results from each individual polling station, it does not meet requirements for internal audit of results by the EMB. An internal audit requires two separate data paths that can be used to verify each other. Systems proposed, for countries represented in the cases studies, on results reporting provided an independent data flow from polling station to headquarters providing an adequate basis for an EMB to conduct an internal audit. This allows a comparison of the data that came direct for the polling station with the data that travelled through the administrative hierarchy.

The importance of such an internal audit capacity becomes obvious if we adopt the perspective of someone whose intent is to steal an election. Attempts to detect cheating often focus on activities that will impact the count at the polling station, e.g. vote buying, ballot stuffing, "chain" or "serial" voting,[17] pre-marking ballots,[18] etc. While this kind of cheating is undoubtedly practiced in some elections, it is the least effective kind of cheating.

16 2008 General Election (Unofficial Results) Produced by the Arizona Secretary of State's Office, http://www.azsos.gov/election/2008/General/2008_General_results_query.htm

17 Chain voting refers to a practice where the "cheater" starts with a single blank ballot. The ballot is marked, and given to the first voter, who puts the pre-voted ballot in the ballot box and brings a blank ballot out of the polling station. The second ballot is marked and sent in with the next voter, and so on in daisy-chain fashion.

18 Pre-marking ballots has been observed in polling stations when the poll worker demonstrates to the voter how to mark the ballot, and in the demonstration, places a small mark in the vote area for the chosen candidate, while explaining that "the mark goes inside the box". This small mark will not invalidate a vote for that candidate, but if the voter votes for a different candidate the election official can claim that this is a spoiled ballot since it has markings for two different candidates.

A much more effective cheating method is to influence those who are tabulating the results, where a single digit added to a tabulation sheet can add hundreds or even thousands of votes. This level of cheating can have such a dramatic impact on the outcome of elections that it can be one of the primary motivations to pass laws requiring implementation of electronic voting.[19]

Fully automated elections is one way to make it more difficult to alter the results during consolidation of votes, however it is an expensive fix that still does not exclude the possibility of manipulation by technical insiders. A much more cost-effective approach is to revise the reporting process to provide for redundant transmission of results. A verification or audit process can then be put into place that will detect any attempt to alter the votes from the polling station, or by falsifying calculations in the tabulation. Various technologies can be used to provide this second stream of data, including SMS text messaging, voice phone call, fax, radio, or direct transportation of paper.

End to end verification of individual votes

There are a number of proposals that would provide an additional level of verification, allowing each voter to confirm how his or her vote was counted. For examples of this level of verification see the Kazakhstan case study in the E-voting section of this guide, or the Scantegrity project.[20] These systems bring their own controversy. Proponents point to the total accountability the systems provide, while detractors point out that such systems violate the secrecy of the ballot and can be abused by parties wishing to influence voters through vote buying and/or intimidations since they allow a method for the voter to prove how he/she voted.

Steps in Implementing a Results Reporting System

Reporting of election results is an area where technology can be quite simple and still be effective, but where no level of technology can compensate for an inadequate legal and procedural framework or poorly trained staff. The following case studies involve almost all of the steps recommended in the introduction to this study. Advance planning is critical to allow time to evaluate options, create additional reporting forms and procedures, and develop automated systems to support communication, data entry, tabulation, and audit processes. Broad stakeholder support can be essential to gain consensus on timing of release of data and to work out how data will be shared with media outlets. Because the

19 "With minimal human intervention in counting and canvassing, and speedy transmission of election results, we can eliminate the doubt that always hangs over every election exercise in this country." Senator Richard Gordon, author of automated election law, quoted in Senate of the Philippines Press Release, Jan. 29, 2006 http://www.senate.gov.ph/press_release/2006/0129_gordon1.asp

20 http://www.scantegrity.org

system must function under heavy load at a time when many eyes are focused on the process it is critical to do extensive pilot testing, to carefully define all procedures and communications protocols, and conduct effective training of participants at the polling stations and in the administrative offices.

Case Studies – the Contexts

The following case studies represent attempts to create results systems in fairly contentious election environments. The technology platforms in each case are relatively simple, and the success or failure of the systems has much more to do with non-technological details than with the technology.

Kenya struggled with getting agreement on the most effective way to communicate results from 2001 to 2007, a period which saw two presidential and general elections, and a referendum on adoption of a new constitution. The system and procedures are reasonably well-defined but fear about the political reactions, particularly during the December 2007 Presidential and General Election, obstructed full implementation of the system. The failure to report preliminary results was one factor that contributed to widespread suspicion that the EMB was hiding something and possibly manipulating the results.[21]

Indonesia attempted a complete overhaul of the results reporting system in a very short timeframe through the use of Intelligent Character Recognition (ICR) for 2009 Legislative Assembly Elections, without adequate lead time for agreeing on procedures, defining and testing the technology, training, or procurement. Unsurprisingly, the system failed to deliver the required information for publishing election results. Three months later the EMB adopted a new system based on SMS text messages for the presidential election, and chose to do a pilot test. The case study documents both the failed ICR system and the conditionally successful pilot of the SMS system.

In Armenia, IFES was asked to help create an election results reporting system that would address problems of widespread manipulation in reporting and tabulation of results. The system developed in 1998 was one of the earliest implementations of full parallel vote tabulation. The system was able to produce fully auditable results, including publication on a CD-ROM of all polling station counts and scanned images of the report protocol forms signed by precinct electoral commissioners (the Armenian equivalent of presiding officers).

21 Final Report by Johann Kreigler on the 2007 elections in Kenya, p 133-134

Kenya: Results Compilation and Transmission for Effective Communication

Michael Yard

Background

The 2007 general elections in Kenya have been widely analyzed, and the Election Commission of Kenya (ECK) received much of the blame for the failure of the electoral process.[22] It is tempting to conclude that these elections were conducted in a less credible manner than the previous successful Presidential Election of 2001 and the Referendum of 2005. The public reaction to all three of these events would seem to support such a view. In the 2001 and 2005 elections all parties accepted the outcome with no accusations of either mismanagement or fraud, whereas the results of the 2007 election were widely disputed by both Kenyan and international observers. The disputed outcome of these elections was, however, the result of many factors over which the ECK had little or no control; similarly the successes of the two previous exercises were in large part the result of factors outside the control of the ECK.

22 Report of the Independent Review Commission on the General Elections held in Kenya on 27 December 2007, Judge Johann Kreigler, et al., http://www.dialoguekenya.org/report.aspx

Reports on this election have focused on the political factors that led to the failures of the election. For the purposes of this evaluation, the degree of public acceptance is only one element to be considered in scoring the technical conduct of the election, realizing the ECK only has indirect influence over this factor. More important for purposes of technical evaluation are the aspects of election management over which the ECK had direct responsibility and control.

IFES has previously observed that the broad acceptance of the 2001 General Election results was influenced more by the landslide victory scored by the opposition than by the technical conduct of elections. Those elections revealed many serious flaws in the production of voter registers, the distribution of materials, the counting procedures, etc., and these flaws were overlooked because of the outcome of voting. When an opposition party or candidate wins by such a wide margin there is little reason to suspect manipulation by government, and little incentive to focus on flaws that might have disenfranchised a few thousand voters out of an electorate of 13 million. Instead the winning party, the media and the public focus on the victory and future transition.

Similarly, the 2005 referendum was widely regarded as a successful election. The ECK did in fact display a much-improved capacity for managing elections in 2005 as compared to 2001,[23] but it should be noted that a national referendum is a much simpler management exercise by comparison. There is a single national ballot with two choices, which significantly simplifies production, distribution, counting, and reporting requirements. Again, the referendum results were seen as a notable victory by the opposition over a government who had pushed for passage of the referendum.

23 "In recent years, the electoral commission has become more professional and more adequately funded, except in the area of voter education. It currently enjoys significant independence from the government, although this issue may resurface in the run-up to the 2007 national elections as some commissioners' terms end. Several stakeholders, such as human rights and election-observation groups, have emphasized the need for the government to continue to make inclusive and broad electoral commission appointments." Freedom House, Countries at the Crossroads: Country Report – Kenya, 2006, http://www.freedomhouse.org/modules/publications/ccr/modPrintVersion.cfm?edition=7&ccrpage=31&ccrcountry=133

In the lead-up to the 2007 elections technical advisors repeatedly cautioned that this would be a different kind of election. Public opinion surveys made it clear that it would be a very close contest between the incumbent Mwai Kibaki and the opposition Raila Odinga, with no clear advance indication of who would prevail. In such a tight contest there is clear incentive for supporters to try to get every possible vote, a strong temptation to plant additional votes if at all possible, and an equally strong incentive to try to discredit votes for the rival party. When every vote is seen as significant in determining the outcome, the electoral management body will be under heavy scrutiny as participants seek to gain any possible advantage.

Given that public confidence in the election can be impacted by multiple influences outside the control of the election management body, we should resist the temptation to oversimplify our analysis by saying that a widely accepted election result is the sign of a well-managed election process. Rather, the marks of a well-managed election include timely production and distribution of materials, consistent quality training of election workers, uniformity in the application of laws and regulations throughout all constituencies and polling stations, strong public awareness of how to vote, and transparency of the voting and reporting process.

ECK showed consistent growth in many of these areas from 2001 to 2007, a fact that was reflected in the relatively smooth conduct of voting. There were few incidents of violence or unrest from the time the polls opened until the closing of the polls and beginning of results reporting. The vast majority of voters appeared at the polling station, found their names on the voter register, received a ballot, voted, and went home without incident. The vote reporting method reflected similar advances over systems deployed in previous elections; a majority of reporting period results flowed from polling station through constituency offices to the Media Election Results Center without incident.

Review of Reporting System

Outsourced System

With a goal of streamlining the vote reporting system, the ECK outsourced development of an integrated system less than 16 weeks before the election to allow data entry at the constituency level, and direct communication with headquarters via a wireless general packet radio service (GPRS) connection to laptop computers in constituency offices. This system as specified was designed to streamline reporting by providing near-instantaneous access by the media center to results once they were entered at the constituency office.

The system specified the ability to:

- Enter data for all levels of elections (presidential, parliamentary, civic
- Validate data both by comparing to number of registered voters and by ensuring that total votes for all parties do not exceed number of votes cast at the polling station
- Track valid votes, spoilt ballots and disputed ballots
- Output data in a variety of tables and graphs for reporting purposes
- Allow data entry at HQ for any constituency that encounters a problem either with their system or with data transmission

Actual System
Ten days before the election it became clear that the outsourced system would not be ready for use as the primary reporting system.[24] The ECK decided to deploy the system only as a test for future use due to a lack of time for testing and missing features (the system had no ability to output required reports). At this time, the ICT Manager contacted IFES to request assistance in creating a reporting system that could produce output displays for the Media Election Results Center (MERC), based upon results reported by fax and/or phone from constituency offices. The decision was also made by the ECK at this time to only release results at the constituency level once the constituency results were finalized.

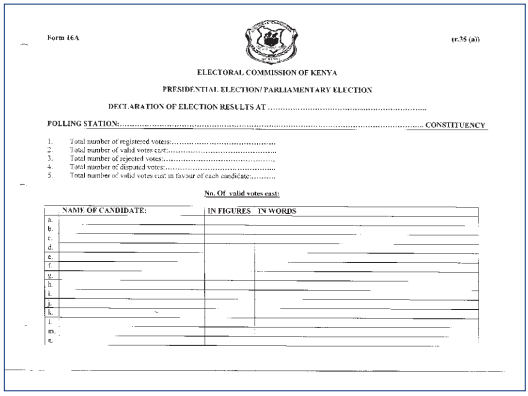
With IFES' support, the ECK produced a system capable of displaying results in a variety of formats including:

- Progress of Count
- Voter Turnout – Constituency and Cumulative
- Presidential Results – Constituency and Cumulative
- Parliamentary Results – Constituency and Cumulative
- National, Provincial, and Constituency maps representing all of the above

Although the ECK did use this system, they ignored many of the

24 "Consultant Report to ECK on Results System", Michael Yard, IFES, January 2008

recommendations of both IFES and the UNDP concerning when the results should be reported, as well as the recommendation to report disaggregated results from the polling stations, thereby allowing a degree of auditability.



Form 16A (r.35 (a))

ELECTORAL COMMISSION OF KENYA

PRESIDENTIAL ELECTION/ PARLIAMENTARY ELECTION

DECLARATION OF ELECTION RESULTS AT .....

POLLING STATION:..... CONSTITUENCY

1. Total number of registered voters:.....
2. Total number of valid votes cast:.....
3. Total number of rejected votes:.....
4. Total number of disputed votes:.....
5. Total number of valid votes cast in favour of each candidate:.....

No. Of valid votes cast:

NAME OF CANDIDATE:	IN FIGURES	IN WORDS
a.		
b.		
c.		
d.		
e.		
f.		
g.		
h.		
i.		
j.		
k.		
l.		
m.		
n.		

Figure 5 - Form 16A - Declaration of Results

Weaknesses of the Reporting Process

As is often the case in the failure of systems, the greatest weakness in the vote reporting process hinged not on any problem with the technology but with policy and procedures, in this case on an overly rigid interpretation of a law that provides for a chain of reporting from presiding officer (polling station) to returning officer (constituency) to ECK Headquarters. In discussions with IFES and UNDP in which this author participated, the ECK repeatedly cited this legal requirement in turning down proposals to overhaul counting, thereby abdicating their responsibility to improve the speed and accountability of the process.

While the law appropriately gives responsibility to the Returning Officer to review polling station results, adjudicate any counting disputes and correct any obvious errors, the Kenyan EMB should have been authorized to implement systems that prevented the returning officer from amending polling station results and tabulations without regard for accountability.

The ECK had a mandate to create procedures that ensure elections are conducted in a transparent manner, and all election workers at every level are held accountable for the accuracy, impartiality, and integrity of their actions. Further, the ECK had a responsibility to the people of Kenya to report results in a manner that would allay suspicions and provide a strong counter-argument to accusations of electoral fraud. The best way to fulfill this responsibility is to create a system that provides full transparency and accountability as described below. This system was recommended to the ECK but was rejected for a variety of reasons listed after the system description.

Recommendations

Use pre-printed forms for reporting results from the polling station. The ECK had a list of all polling stations and a list of all candidates. IFES provided samples in 2001, 2005 and, 2007 that demonstrated how easily the ECK

could produce counting forms that have polling station information and candidate information pre-printed. Since these forms can be produced in identical format to current counting forms (Figure 5), their use would not require any change to laws or regulations – the ECK would simply be using the computer to fill in some information in advance in order to save work for the presiding officer. In this case, the computer system could generate the report form with information pre-printed for:

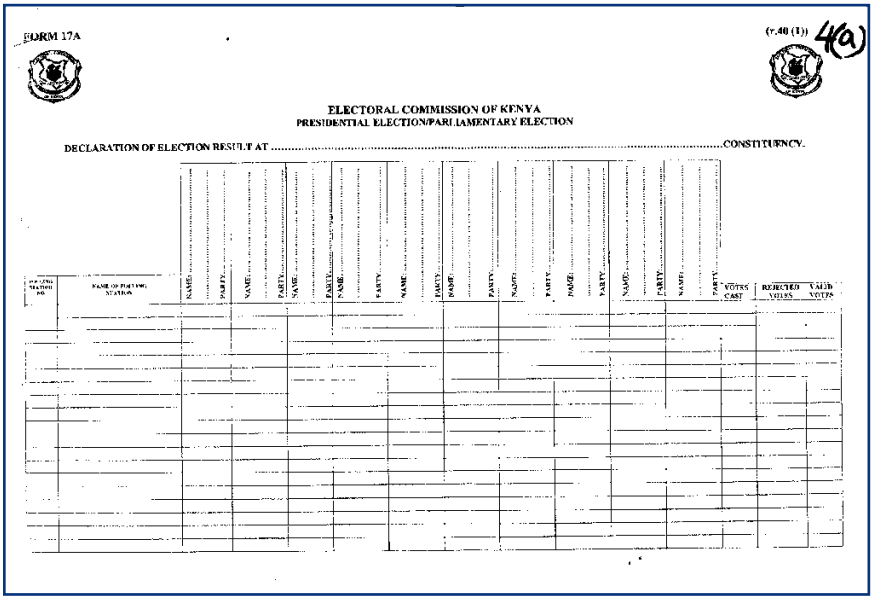
- Polling Station
- Constituency
- Number of registered voters
- Names of Candidates

Doing so would save time in the counting and reporting process at the polling station, increase accuracy and readability, and allow adequate time to provide a hand-written and signed copy of the results form to all party agents. Upon completion, this form should be sent to the returning officer, with a full copy sent directly to ECK HQ to be used for verification of the results compiled by the returning officer.

Use pre-printed forms for tabulating results at the constituency offices. Again, these could be formatted identical to current tabulation forms (Figure 6). The existing procedures required the returning officer to hand write all candidate names and all polling station numbers onto these forms, wasting time and providing increased possibility of error. The ECK could also provide space for the returning officer to indicate results as reported from the polling station, any amendment to the results made by the returning officer, and the reason for each amendment.

Upon receipt of the original counting forms from the polling stations and the tabulation forms from the constituency office, the ECK should publish detailed results on a CD-ROM that includes:

- A spreadsheet detailing all results at the constituency level, with further detailed breakdown showing the results from each polling station
- Scanned images of the polling station counting sheets (These are already posted at the polling station and are thus publicly accessible; the ECK would simply be adding a layer of transparency and accountability by making them all more easily available


FORM 17A

(r.40 (1)) 4(a)

ELECTORAL COMMISSION OF KENYA
PRESIDENTIAL ELECTION/PARLIAMENTARY ELECTION

DECLARATION OF ELECTION RESULT AT .....CONSTITUENCY.

Figure 6 - Constituency Tabulation Form (first page)

- Scanned images of the tabulation forms complete with annotations explaining every amendment made by the returning officer

Such a system would provide a much needed level of accountability and transparency to counter claims of impropriety on the part of election officials. If any election official attempted to fraudulently alter the results, this system would make it nearly impossible for them to do so without being detected. On the other hand, because of the level of transparency, by clearly demonstrating the chain from polling station to announced outcome, this system can protect election officials against false charges of manipulating the results.

In addition to this system of accountability, it would be desirable for the ECK to announce partial incremental provisional results as they are reported from the polling stations. To do so does not require announcing the detail of each polling station, but only aggregated results. By announcing these aggregated results as the count comes in from each polling station, the ECK could provide for slow and gradual emergence of voting trends. By contrast, by waiting for an entire constituency to report, the ECK creates a system that is subject to large, sudden changes in the results. Sudden reversals create a more emotionally volatile process than slow gradual trends.

Reasons for Failure of Systems

The reporting systems failed to achieve the desired results for a variety of reasons; three of which, are identified here.

1. Unclear vision – There was never a clear consensus on what the system was supposed to accomplish. Without a vision and clear objectives from the outset, the project was off course from the beginning. The developers of both the wide area network (WAN) and fax systems had vague ideas about the objectives. Was the primary purpose of the system to deliver accurate final results or fast provisional results? Was transparency of the process as important as speed of delivery? Should post-election auditability outweigh accuracy, i.e. should the system correct detected math errors or leave them to provide an audit trail?

2. Inadequate advance planning – By the time the ECK began to discuss a results reporting system, their Supplies Department had already purchased results reporting forms identical to those used in previous elections; the commission was unwilling to discard these forms in favor of pre-printed forms. Late delivery of specifications and contracts contributed to a failure to develop the WAN-based system in time for deployment. A last-minute request for a fax-based system did not allow adequate time to clarify whether the system was to be used for reporting preliminary provisional results or final verified results.

3. Political pressure – The primary reason for failure of the reporting system was political pressure exerted upon the ECK. There was pressure before the elections for the commission to not report partial provisional results. And there was pressure before the results were transmitted for the commission to announce the incumbent president had won, an announcement that was immediately rejected by the opposition.

Indonesia: Intelligent Character Recognition and SMS Results Reporting

Michael Yard

Background

Many separate elections were conducted in Indonesia in 2009, four levels of legislative elections on 9 April and a presidential election on 8 July. The management of vote counting and tabulation for the national People's Representative Council election *(Dewan Perwakilan Rakyat,* the DPR) and the presidential election introduced two new technologies to Indonesian elections.

Even before the polls opened for the April 2009 Indonesia Legislative Election, much of the story line had been written in the international media. This was a significant step forward for Indonesian democracy. It would be the third successful elections of the post-Suharto era. Support for hard-line Muslim fundamentalist parties had declined. From a broad perspective on democratic development this election represented significant progress.

However, in the weeks following the legislative election the central story was not one of democratic progress but of problems with election management. Media claims about the number of persons disenfranchised by an inaccurate voter register ranged from tens of thousands to as many as 40 million.[25] The vote tabulation system was plagued by problems that made it unusable, creating an opportunity for widespread manipulation of results. The Komisi Pemilihan Umum (KPU), Indonesia's electoral commission, announced a change in the seat allocation formula after the votes were counted, resulting in a transfer of seats from smaller parties to larger parties with greater political influence. The number of seats won by parties was announced without a corresponding announcement of the voting results. The media response was brutal, with one editorial in the country's leading newspaper going so far as to state that the alleged incompetence of the KPU was a primary redeeming element for the election: "We should be thankful that the current KPU is made up of a bunch of incompetent personnel. At least, this has tampered suggestions of vote rigging. Were they seriously as competent as they should be, we would be left with fraud as the only logical explanation for this electoral mess."[26]

Three months later, after the presidential election conducted by the same EMB, the media reports gave center stage to the re-elected President and expectations for his upcoming second term. The substantial complaints by the losing candidate focused on the problems of potential disenfranchisement of supporters through the faulty voters lists. Other less severe, but still serious, complaints about a voter education banner produced by KPU were vocalized. However, compared with the legislative election there was reduced criticism on how voting and counting were conducted.

A number of factors contributed to the turnaround in media coverage of the KPU. The presidential election was much simpler, with a single contest with three candidate pairs, compared with thousands of candidates contesting 560 seats in the DPR Legislative Election. And, since the KPU had conducted such a complex election only three months earlier they were much better prepared to manage all of the logistical elements of the presidential election. However, there is no denying that the implementation of vote reporting technology played a major role in media and public perception of KPU's management of the elections.

25 There is no objective basis for determining the actual number of eligible voters, and due to large numbers of duplicates and deceased on the voter list it is also impossible to determine the number of actual voters whose names are on the list. Therefore, any speculation as to the number disenfranchised is likely influenced more by political motives than by source data.

26 Jakarta Post, 1 June 2009

Indonesia is the world's third largest democracy with approximately 170 million voters assigned to 530,000 polling stations for legislative elections and 450,000 for presidential elections. The task of managing elections of this magnitude would be daunting even for a highly trained and experienced election management body. For a KPU that was newly appointed in 2008 and heavily dependent upon the government for budget allocation and cash flow, the task, at times, proved to be overwhelming.

This case study examines two different technologies the KPU selected for reporting election results. Both systems were based upon proven technologies that are used widely outside elections so this is not a study of a failed technology vs. a successful technology; rather it is a study of a failed implementation vs. a successful implementation.

Legal and procedural framework

The election on 9 April 2009 was a multi-level election allowing voters to choose representatives for the Regional Representative Council (DPD), the People's Representative Council (DPR), the provincial level People's Representative Council (DPRD) and the regency and municipality level People's Representative Council (DPRD/K). Election law mandates that results for the national level DPR and DPD must be announced within 21 days of the election. Results from the polling station are written onto a Form C1 – *Official Report of Voting and Vote Counting.* According to the law, a copy of the C1 is provided to each of the contestant witnesses and supervisors, and the original goes to a kecamatan, or subdistrict, electoral office for consolidation. The results then pass through a Regency/Municipality KPU and Provincial KPU for consolidation before finally arriving at KPU Headquarters.

In 2004, the KPU hired 2,000 university students to assist with data entry of the election results at the 5,480 kecamatan level offices in order to meet the demands of this timeline. The data was entered in time but there was limited validation, resulting in questionable accuracy. There were a number of problems with this approach to results reporting:

- Slows down national results consolidation
- Opportunity for error or mischief at each level of consolidation
- No independent audit trail
- Data entry process is subject to high error rates and even direct manipulation

Technologies

Options considered for 2009

The KPU considered two technologies to help address the issues presented from the 2004 experience. The first, mobile phone text messaging, or SMS, could potentially streamline the information flow from the polling station to headquarters and provide more immediate provisional results. The SMS system, with appropriate secure features integrated, could also provide some level of validation for the official results reported on the C1 forms. The second technology considered was Intelligent Character Recognition, which was seen as an alternative to the 2,000 temporary data entry staff. The ICR approach promised to provide greater speed and accuracy than manual data entry.

SMS

Short Messaging Service, or SMS, is a standard originally designed as part of the specification for Global System for Mobile communication. The original SMS specification provided a protocol for sending short text messages between two GSM mobile phones, though it quickly expanded to allow for communication between a wide variety of communication devices including all types of mobile phones, satellite phones, pagers, and computer systems.

The primary benefit of the proposed SMS results system was that it would provide for rapid reporting of provisional results. Because of the complexity of the elections, an early recommendation was made that the SMS system should focus only on results of the DPR. In addition, although the voter had an option of voting either for the party or for a specific candidate within the party, the system would only report the total number of votes for each political party. Finally, the vote count would not be able to address the number of seats allocated to each party since this was dependent upon a national threshold that could only be determined once the total number of votes was known.

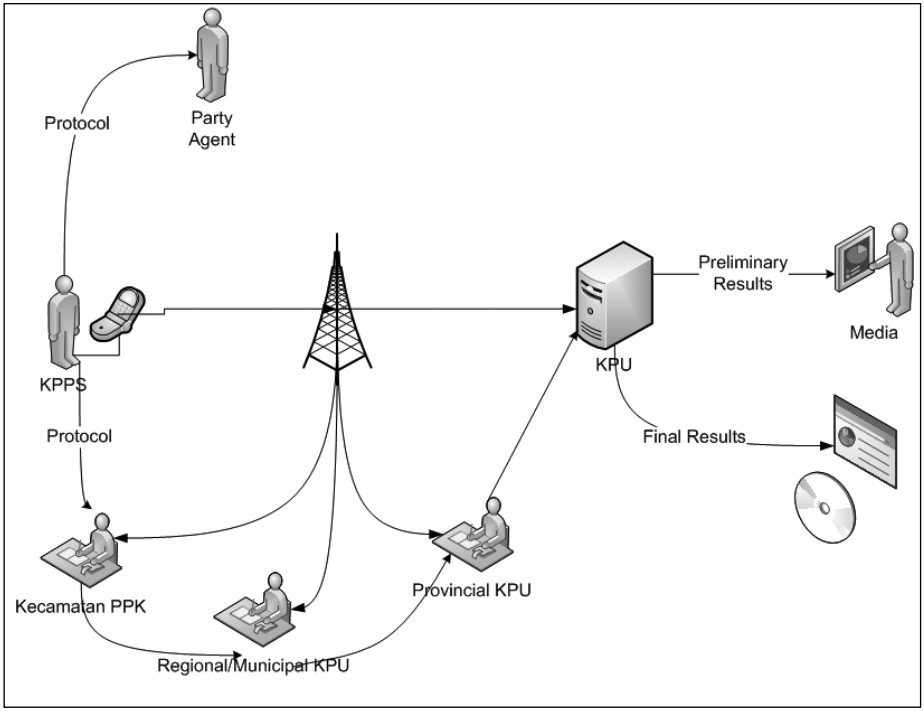


Figure 7 - Data Flow Diagram

The SMS system was designed to allow each polling station to transmit results immediately after completion of vote counting. In order to more accurately reflect the traditional movement of the paper C1 forms, the system would relay each message to the kecamatan, regional/municipal, and provincial KPU offices allowing each geographical unit simultaneous access to reported results.[27] All results would be tabulated at KPU Headquarters in Jakarta and published online as they were received. Upon completion of reporting, the results would be published on a CD-ROM and distributed to all political parties and key stakeholders. The data flow is depicted in Figure 7.

Two security models were considered. The first preference was to provide a pre-paid SIM card to every polling station; the SIM card provides authentication with the local provider and a unique phone number as well as sufficient credits to allow sending the results messages. This approach would provide strict control over what phone number could send a results message; any messages sent from unregistered phone numbers would be ignored.

27 Although this capability for simultaneous transmission was built into the system, it was not used for the pilot project in which data was only sent to the KPU headquarters.

The second option, less expensive and easier to implement, was for KPU to distribute, as sensitive material through a chain of custody control, a computer-generated key code to every presiding officer. This key code would be included in every message sent from the polling station to allow the system to uniquely identify from which polling station the message originated.

The communication protocol called for each polling station to submit results in the same format. The message would consist of a key word indicating that this was a results message, followed by a series of numbers in the format: *x.yy*; x indicating the political party and yy indicating the number of votes. For example, the message "Result 1.23 2.09 3.122" would indicate that Party 1 got 23 votes, Party 2 got 9 votes, and Party 3 got 122 votes. Ideally, the system would allow for parallel transmission of results from each polling station from two party agents in addition to the transmission from the presiding officer, and all results would be matched before the votes were included in the tally.

The message would be processed by the service provider and forwarded to KPU where a communication server would parse and validate the message and store the results in a database. The server would also send an acknowledgment indicating the total number of votes received. In case of a message that did not adhere to the protocol, the server would send an error message along with a brief help message explaining the correct format for a results message. The database validation rules would detect any attempt to submit more votes than the number of registered voters in the polling station.

A database server would make the results available for reports within KPU as well as to the media and public via the internet.

ICR

Intelligent Character Recognition is often referred to as "handwriting recognition," but actually requires several steps to intelligently convert the image on paper to data. These include:

- Form definition
- Scanning
- Image pre-processing
- Recognition / Validation

- Manual data entry of rejects
- Workflow management

The success of an ICR system is proportional to how well each of these steps is implemented.

Form definition
Before any scanning begins, someone (usually a system administrator) must define the form. This usually involves scanning a blank form, then using a graphical user interface to define the location on the page for each field of data. Once a location on the page has been highlighted, the administrator defines the attributes for the field. The attributes differ depending on the vendor, but include such information as:

- Database field name
- Field type (alpha characters only, numeric characters only, mixed, date, true/false, etc.)
- Minimum and maximum field length allowed
- Validation rules
- Validation lookup table

Scanning
Once one or more forms are defined, scanning begins. Batch flow is very important at this stage, and a common workflow includes scanning an initial batch cover page, followed by scanning each page in the batch. All the pages in the batch are then stored together, organized in a way that makes it possible to retrieve any page later if required.

Image Pre-processing
Each image goes through a pre-processing phase that prepares the image for the recognition engine. The pre-processing may include:

- De-skew – If paper is fed into the scanner crooked, this step realigns the image
- De-speckle – Removes the black “speckles” that often occur in a scanned image

- Registration – Uses marks in the corners of the document to move the image so that every image begins at the same "top left corner" position

- Black border removal – "Drop out" the form from the image, leaving only the handwritten text

- Recognition / Validation

This step is the actual character recognition, which allows hand printed alphanumeric characters to be interpreted by the computer and converted to data. The process is accomplished by comparing a bitmap or vector image of each character to a large sampling of thousands of actual hand printed characters, and making an "intelligent" decision as to what character the shape represents. Some ICR recognition engines also support a "learn" mode, where the system adapts to the specific handwriting of the person(s) doing the handwriting. This type of system is most useful if there are a limited number of registrars each of whom fills in several hundred forms.

The best ICR systems use two or more recognition engines and a "vote process." For each character, each engine submits a "preference vote" showing the top three most likely characters represented by the bitmap image, along with a "percentage of probability." A control module then makes a decision based upon the strength of the preferences.

Accuracy in an ICR system is increased dramatically when it is possible to use database lookup tables and dictionary matching. This technique compares the results of each field to an existing database or dictionary. If the field does not match an acceptable value in the database the field is flagged for review. For example, if the field is identified as "First Name," the software scans a list of all known names. If the interpreted name does not show up in the database, an operator must review the form.

The vendor for KPU's system created a set of validation rules based upon mathematical verification of the C1-***Results Reporting Form***. The validation rules are explained in more detail in the section on ICR for a legislative election.

Legislative Election

SMS Procurement issues

The SMS project was challenged from the beginning. When the initial concept was introduced to KPU in early 2008, little interest was expressed in implementing the system. Then in January 2009 with elections rapidly approaching and with a lack of any alternative, KPU contacted IFES to explore whether there was still time to implement an SMS results reporting

system. Although there was not adequate time to implement the system as originally conceived, IFES proposed a scaled-down system that would not distribute SIM cards, relying instead on polling stations that were able to send a message via the most common mobile telephone service provider, Telkomsel.

One international donor promised to fund the system, and then two weeks later withdrew the offer of funding without explanation. The suggestion was made by Telkomsel that they would provide the service at no cost as a public service if KPU make a formal request for this, but KPU was unwilling to make this request.

With very little available funding and a very tight timeframe for implementation, IFES convened a meeting of SMS service providers to explore whether there was any interest in bidding to provide SMS processing. Although the providers were interested, all felt the time might be too short to guarantee the system would function as intended. An RFP was issued on 1 March 2009 for a provider to process up to 3 million messages in a 24-hour period following the close of polls. No providers were willing to bid at such a late date. Verbal responses from the prospective bidders indicated that they could not guarantee the system would be operational on such short notice and that they were afraid of being blamed for the failure of the vote tabulation process.

Intelligent Character Recognition
Instead of the SMS system, the KPU procured a vote tabulation system based upon use of ICR for data capture. The system was designed to be deployed in 471 ***kabupaten*** (provincial) offices. There was a broad range of office sizes and workloads to consider, with the minimum number of 30 polling stations to be processed in one kabupaten office, and a maximum number of 8,194 polling stations. The kabupaten offices were classified by size: 232 small offices were provided with 30-page per minute scanner; 180 medium size offices received a 50-page per minute scanner; and 56 large offices received two 50-page per minute scanners.

A central reporting system was installed at KPU headquarters in Jakarta. This system was designed to import data from all kabupaten offices via the internet, and a contract was written to provide internet access to all offices.

The software allowed scanning and storage of images of all C1 forms, totaling 12 pages per polling station. An encoding system was designed using a sequence of black marks on each page to allow the software to identify each of the 12 pages.

In response to criticisms of the 2004 system's failure to use any type of double-entry method for data validation, the ICR system implemented a mathematical validation scheme. The C1 form data for each political party included:

- Number of votes for the party
- Number of votes for each candidate within the party
- Total votes for the party

After recognizing all numeric data, the software validation rules required that a + b = c. If this validation rule was met for all parties on the page, the page was deemed valid, otherwise manual intervention was required in order to determine the correct information from the form. Remarkably there was no central plan for how to handle rejected forms; kabupaten officials were left to their own resources to trouble shoot the data capture of the originally rejected forms. Lacking any central KPU guidance the KPUDs performed this in an ad-hoc manner.

Preliminary testing of the system indicated a number of problems. The C1 form provided a sequence of rectangles in which the count of votes was to be written but there was no instruction or sample showing how to fill in the forms. It was possible to submit a form that was validated by the system but gave the wrong result by a simple error in completing the form, as shown in tables 4 and 5.

The ICR system expected to see a single digit in each square, so in this example, the ICR system would mathematically validate the form by checking that 1 + 2 + 4 = 7, and the party would be given 7 votes rather than the 37 votes they actually received.

Table 4 – C1 Form, Correct

Party A votes	23	Party A has 23 votes for the party, plus 9 votes for Candidate 1, plus 17 votes for Candidate 2; a total of 49.	Computer Reads:	23
Candidate 1	9			9
Candidate 2	17			179
Total Votes – Party A	49			49

Table 5 – C1 Form, Incorrect, but still accepted

Party B votes	21	Computer Reads:	1
Candidate 1	2		2
Candidate 2	14		4
Total Votes – Party B	37		7

The system was designed with an assumption of a very high rate of accurate interpretation (99.9% accurate was an often-repeated claim), so very little attention was given to providing an efficient system for correction of mis-read forms or for manual data entry of forms that could not be read at all.

Under heavy criticism for voter list problems, late procurement of ballots, misprints on ballots, last-minute policy changes and other signs of less-than-competent election management, KPU made bold promises about the newly procured ICR system, ignoring obvious shortcomings and external reviews that cautioned the KPU on the implementation of the ICR system. One commissioner went so far as to predict that the ICR system could produce final results within five hours, a very creative application of time-motion analysis.[28] The ICR quick results reporting was promised by the KPU to be broadcast within hours after polling at the KPU's media results center in the Hotel Borubudur.

28 524 scanners were procured with a total maximum scanning capacity of 21,560 pages per minute. Assuming 530,000 polling stations each with a 12 page results form, there were a total of 6.36 million pages to scan. Scanning at the maximum capacity of 21,560 pages per minute would complete the 6.26 million pages in 4.92 hours. This assumes a perfect world with all forms and scanners in one room operating at 100% efficiency. A more realistic projection estimated that it would take 3 days before all the forms moved from subdistrict to regency/municipal office, to kabupaten, and another 2-4 days to scan all forms in the largest kabupatens, allowing release of results within a week. This estimate proved to also be flawed in its assumption that the ICR system would work at all.

Implementation
Planning for the ICR system began very late with initial demonstrations and proof-of-concept testing conducted in January and February 2009, three months before Election Day. The contract was awarded in March, allowing minimal time for software configuration and testing, and no time for training of operators.

Software was distributed to kabupaten offices on a CD-ROM only a few days before the election. Visits to these offices in Jakarta the day before the election indicated that a few had tried to install the software but were unable to test it because they had not been given a user name and password to log into the system. There was no demonstration or corresponding manual provided on how to operate the system with only scant instructions provided to end users.

Election Results Processing
A visit to Jakarta area kabupaten offices in the days following the election revealed that the ICR system was a complete failure with most offices unable to successfully scan a single form. The most significant problems were related to ignoring the vendor recommendation that all forms be printed on 80 gram paper. In an attempt to save money, the forms were printed on much thinner 60 gram paper. By the time the forms arrived at the Kabupaten office, exposure to moisture and humidity had caused the edges of most to curl so badly that it was impossible to feed the form through the sheet-feeder on the scanner. In cases where the form did scan, the paper was not reflective enough, resulting in a "dirty" image that was unreadable. When the scanning team tried to lighten the image to clean it up, the ICR software was unable to recognize the identification marks that allowed it to determine which page was being scanned, resulting in "unknown page" errors. Many forms had hand-written errors that were crossed out, with the corrected numbers being written outside the designated spaces, rendering them unreadable.

In one kabupaten that did succeed in scanning a few forms, there was an error which caused random forms to show up as a "mirror image" of the original. Again, the ICR software was unable to recognize the form at all. When this office was able to successfully scan a page, the software gave an error message after every page that required re-booting the computer.

The end result of these errors was that the much promoted ICR "quick results" reporting system was officially abandoned after failing to process substantial numbers of results. The last information available reflects that on Monday, 20 April 2009, at 8:00 am, total votes reflected through the ICR system was a paltry 12,895,476, barely 10% of overall votes cast. By

default, the KPU returned to the manual results reporting system, with a USD $2.7 million technology implementation written off as a "technology failure."

Presidential Election

SMS Revisited

Because of the large number of problems with implementing an ICR-based results system for the legislative election, the KPU was forced to abandon this system altogether. Official results were processed manually, and the tabulation, fraught with allegations of fraud, was finalized on 24 May 2009. However, in an attempt to provide a timelier announcement of results in future elections, KPU conducted a pilot test project using the SMS reporting system.

The system was implemented using a sole provider, Telkomsel, and security was based upon distribution of a key code to all presiding officers. Due to the shortage of time for implementation there was only a single transmission of results from each polling station; the pilot test team recommended that the system should be expanded in the future to also allow party agents to send results messages. This would ensure a cross validation of results reported.

Dubbed SERIS (SMS Election Results Information System), the pilot project established a goal of a minimum of 4% participation, or roughly 20,000 polling stations. Although there was some discussion of whether the system could achieve adequate distribution throughout the Indonesian archipelago of a large enough sample to predict the direction of the election there was no formal attempt to establish the system as a "quick-count" system; the project was focused more on determining whether SERIS could be a credible option for provisional reporting in future elections. As such, it was hoped the pilot could produce a set of "lessons learned" that could help in future implementation.

IT Audit

With IFES' assistance, the KPU contracted a local IT firm to conduct a pre-election audit of SERIS software, hardware, and communication infrastructure. The audit report identified a number of weaknesses including:

- Need for further documentation including a framework document establishing the vision and scope of the system (subsequently completed
- A user manual for the central software system that would tabulate incoming results (subsequently completed)
- A user manual for those sending SMS messages

- Change and configuration management procedures
- Expanded help desk function to both solve and document problems that occurred in actual use

The audit report concluded that SERIS was appropriate for use internally as a pilot project, "but not valid for official computing" of results. The report further recommended that a disclaimer be attached to any publication of data from the SERIS pilot, specifying that the source of the data is a pilot project representing only a small percentage of the actual results.

Unexpected success of project
By noon of 7 July the pilot project reached its goal of registering 20,000 polling stations to participate, and the number continued to grow throughout the day. By 4:00 pm, that same day, more than 35,000 polling stations had registered, and by the next morning before the opening of polling stations, a total of approximately 104,000 polling stations had registered.

Polling closed at 1:00 pm and counting started. By 6:00 pm on Election Day, SERIS had received reports from close to 91,000 polling stations representing more than 18 million votes. The percentage of support for each party closely paralleled reports of other independent quick counts, leading to a decision by KPU at 8:00 pm to release the results from SERIS to the public, with a clear indication that the numbers represented provisional reporting and were not an official declaration of results. The SERIS results were simultaneously posted on the KPU's website with a disclaimer that the results were only reflective of a sample collected through the test of the SERIS system.

Response to the project
The decision to announce results of the SERIS pilot was not universally applauded; in the following days there were some complaints by losing parties about "international" interference in election results. Media focus, however, was consistent in its focus on implications of the re-election of the incumbent, a major contrast with media focus on problems with election management that followed the legislative election.

Although, the KPU successfully implemented the SERIS program it was insufficiently prepared to speak to the mechanics and technology behind the program. Therefore, its decision to release the SERIS data even with certain caveats, although commendable from a transparency

perspective, should have been reconsidered. When encountered by opposition party allegations that the SERIS program had been selectively implemented to ensure that results reported reflected an insurmountable victory for the incumbent president and his running mate, it was incapable of explaining that SERIS results were not official results and only reflected results for a select sample of those polling stations which had securely pre-registered into the SERIS system. The chairman of the KPU was not sufficiently versed to explain the limited nature of the SERIS test, when requested to provide clarification on why the SERIS system only produced approximately 90,000 polling station results and not results from the full 450,000 stations. With better public information capacities the KPU would have been able to deflect efforts to raise questions about the legitimacy of the technology.

“Despite these challenges and setbacks, the 2009 experience with technology was a significant learning experience for the KPU and they are now poised to utilize the SERIS system positively for the 2010 Pilkada Elections.”

Despite these challenges and setbacks, the 2009 experience with technology was a significant learning experience for the KPU and they are now poised to utilize the SERIS system positively for the 2010 Pilkada Elections.

Armenia: Pioneering Transparent and Auditable Results Reporting

Michael Yard

Background

Armenia does not have a stellar record for conducting credible elections. Observer reports for every election since 1996 have identified major problems in the election, including many examples of outright fraud of a magnitude that could affect the outcome of the elections. This does not mean that there have been no successes – only that the opportunities for fraud have been wide enough to circumvent any checks and balances put into place.

The 1998 election in Armenia is, however, significant for providing one of the earliest examples of a completely transparent and auditable results reporting system. The technology used is obviously outdated, relying on floppy disks and fax machines, but the experience provides a solid example in the use of refined procedures and automated tools to create a sound results reporting system.

Problems with 1996 election

A number of problems were identified with regards to the procedures used to count the votes in the 22 September 1996 presidential election. Problems that had been documented by IFES and the Organization for Security and Cooperation in Europe included the following:

- Irregularities in the counting procedures
- Widespread violations of electoral law requiring the posting of results protocols in the precincts
- Instances of refusal to provide copies of results protocols to candidates' proxies, as required by law
- Slow delivery of protocols from some precincts (e.g. some precincts in Yerevan did not deliver protocols to the regional office until three days after the election)
- Discrepancies between the number of ballots distributed and the number of votes cast, most significantly in the Aragatsotn Region where the total number of voters voting was reported as 46,248, but the total votes for all candidates was reported as 54,846.
- Failure of the ballot accounting process resulting in 22,013 "missing" or unaccounted-for ballots
- Refusal of the Central Election Commission to provide election protocols from all polling stations to the Constitutional Court in response to a petition for a recount by opposition parties

Some of the problems identified may have been due to information systems which were inadequate to provide an orderly flow of vote count information from precinct to community to region to CEC. Many of the problems were clearly due to a failure in following procedures outlined in the electoral law.

No automated system can correct accidental or deliberate violations committed by those responsible for counting and reporting the results. However a good information system can help to establish orderly procedures for handling the flow of information and create transparency by providing detailed reporting of the results.

In January 1996, IFES was invited to recommend improvements for the election technology infrastructure. With elections scheduled for 16 March, less than eight weeks after IFES' assessment, there was inadequate time to address any technology issues beyond the vote reporting system. Therefore, the focus of IFES' intervention was the design of a sound system for helping the Regional Election Commissions and the CEC with counting and summarizing votes.

The Technology – System for Vote Count and Results Dissemination

The system used for counting and tabulating results from the 1996 elections was inadequate both in the manual procedures and the computer systems used.

Precinct

The counting process in the precincts was cumbersome and lacked simple mathematical validation which could be used to improve accuracy on the protocol forms. For example, the total number of votes in favor of all candidates plus the number of votes against all candidates plus the number of invalid ballots should equal the number of signatures on the voter register. There were four different places where simple totals could be added to the protocol to assist with double checking to catch any counting errors. Candidate names were handwritten onto the summary protocol along with the number of votes for each candidate, allowing discrepancies from one precinct to another in the order in which the names are recorded, and making data entry at the regional and central levels more difficult.

Unfortunately, the electoral law spelled out every detail of the process to be used in the regions, including the number of protocols to be completed, the order in which they should be completed, and the information required to be included on each protocol. Suggestions to include additional information such as the mathematical validation described above met with objections that this was not in the law. Suggestions that the candidate's names be printed on the protocols met with objections that there was not enough time between the final date for candidates to withdraw and the date of the election to allow for distribution of the forms. (It is unclear why the printing and distribution of the protocols should take longer than printing and distribution of the ballots.)

Due to the level of detail with which the electoral law describes the counting process in the precincts, and inadequate time to print candidate's names on the counting protocols, the only change IFES was able to implement in the precinct counting process was to create a training module that emphasized the importance of publicly posting protocols and providing copies to all proxies and international observers who request a copy.

Community
The Community Electoral Commission (CoEC) was responsible for collecting materials from the precinct and forwarding all summary protocols and ballots to the Regional Electoral Commission (REC). The CoEC keeps the box of ballot coupons (one coupon torn from each ballot used for voting), and is required to complete a protocol listing the number of ballot coupons in the box for each precinct. This protocol is forwarded to the CEC where it was to be used for comparing the number of ballots used with the number of votes cast in each precinct.

As in the precincts, the steps to be taken by the Community Electoral Commission were spelled out in minute detail in the electoral law, making it difficult to make improvements.

Region
At the REC, IFES identified a number of steps which could significantly improve the transparency and accuracy of the counting process. Most important was using parallel data entry so that all data from the precinct protocols were validated before any regional summaries are printed. With the approval of the CEC, IFES arranged for a local vendor, Armentel, to provide additional computers, experienced data entry operators, technicians, and a data entry and validation program for every region. The United Nations Development Programme agreed to provide transportation for the computers and technicians for the purpose of installing and testing the extra computer and software, and for data entry staff and technicians to and from regional offices on Election Day.

The revised process for data entry at the regional level included:

- Logging the time the protocol is received from the precincts
- Data entry by Regional Electoral Commission staff
- Parallel data entry by independent computer operators
- Validation reporting to reconcile differences between the two data entry processes
- Regular summarization reports and a final report detailing the vote count by precinct, with regional totals
- International observers to monitor the counting process
- Delivery of validated data from both data entry processes to the CEC in separate sealed envelopes

Armentel agreed to provide training for their own staff, and to train Regional Electoral Commission staff in the new software at the UNDP training center.

Regional Electoral Commission Procedures

Overview

The data processing team in each region consisted of four persons: data entry supervisor appointed by the regional chairperson, data entry operator from the REC, data entry operator from Armentel, and a computer technician from Armentel who was available to help resolve any technical problems. Each REC had two computers and a printer.

As each protocol was received from the precincts, it was entered into a logbook by the supervisor, who then faxed a copy of the protocol to the CEC and then gave the protocol to the REC computer operator. After entering data from the protocol, the REC computer operator gave the protocol to the Armentel computer operator. The Armentel computer operator entered data and then gave the protocol back to the supervisor. The data from the two computers was compared periodically, and a comparison report was given to both computer operators to make corrections. Reports were also printed periodically showing the progress of the vote count. A detailed description of these steps follows.

Receiving and logging protocols from precincts

As each protocol was received from the precincts, the supervisor recorded the time of receipt in a log book. This log was used to determine whether all protocols had been received. A log entry included: community number, precinct number, time received from the precinct, and the time the protocol is filed.

Table 6 – Sample Log of Precinct Protocols

Community #	Precinct #	Time received	Time Filed
01	01	1:32	1:52
01	02	1:32	
02	01	1:50	

After receipt is logged, the protocol is faxed to the CEC and the supervisor checks (✓) the top right corner of the protocol. The protocol is then given to the first data entry operator. The first data entry operator enters data from the protocol.

Data Entry
Before entering data into the computer, the operators of both computers run a "Summary Report of All Precincts." This report should show zero votes from all precincts.

As protocols were received and logged, each computer operator entered the following information from the protocol:

- Total number of voters, based on the lists of voters
- Number of voters registered and receiving ballots, based on the signatures
- Number of ballots given to the Precinct Electoral Commission
- Number of canceled ballots
- Total number of valid ballots corresponding to approved specimen present in the ballot box
- Number of ballots recognized as invalid

Table 7 – Armentel Computer Validation Process

Step 1	REC computer operator selects menu choice "Export data to diskette"
Step 2	Give diskette to Armentel computer operator
Step 3	Armentel operator inserts diskette into Armentel computer
Step 4	Armentel operator selects menu choice "Validate"
Step 5	Supervisor reviews the report In the case of any differences between the input on the two computers, the supervisor will compare the report with the original protocol. If the supervisor is unsure of the correct interpretation of data from a protocol, the regional chairperson should make a final decision as to the correct data
Step 6	Both computer operators use the Validation printout to correct any listed errors.

- Number of ballots not corresponding to approved specimen
- Number of ballots voted against all candidates
- Number of votes given in favor of each candidate
- Total number of votes given in favor of candidates

Upon completion of data entry, the REC computer operator gave the protocol to the Armentel computer operator. The Armentel computer operator followed the same steps, and then gave the protocol back to the supervisor.

Validation
When work flow allowed, the computer operators ran the validation program, called Validate, which compared the data from the two computers. In order to perform validation, it was necessary for the REC computer operator to export data to diskette and give the diskette to the Armentel computer operator. The Armentel computer operator inserted the diskette into the Armentel computer and then ran the Validate program which compared data from the Armentel hard disk with data on the diskette.

Reporting
The computer operator printed out summary reports approximately every half-hour, or as requested by the regional electoral commission chairperson. These reports gave a detailed listing of every precinct that had been validated, along with regional totals.

Sending Data to CEC
When all data was entered and validated, and the final report printed, each computer operator exported data to floppy diskette. This was done three times on each computer, creating a total of six diskettes. Two diskettes from each computer were sealed in envelopes, labeled “Data from computer # 1” and “Data from computer # 2.” Both envelopes were sent with the regional summary protocols to the Central Election Commission. The third diskette from each computer was kept at the REC as a permanent record.

Central Electoral Commission Procedures

Overview

During the vote count for the 1996 presidential election, the Central Electoral Commission used a simple Microsoft Excel spreadsheet to tabulate the results from the regional counts. This spreadsheet approach did not allow publishing results by precinct or automated audit capabilities. A manual inspection was reportedly done to compare the number of ballot coupons counted in each region with the number of votes. However, large unresolved discrepancies confirmed that this approach was inadequate. Also, the lack of detailed reporting capability resulted in a lack of transparency; it was impossible in 1996 to demonstrate clearly that the announced results were an accurate aggregation of the votes as reported by the precincts. The following procedures and systems were defined for 1998.

The Central Electoral Commission data processing staff had three different phases of work in counting the votes:

- Production of preliminary results report
- Audit of precinct and community protocols to produce a final results report
- Production of a CD-ROM publishing the final results

CEC also had four different sources of data to process:

- Faxed precinct protocols
- Original precinct protocols
- Community protocols
- Diskettes from the regions containing validated data from all precincts

The data entry staff at the CEC consisted of five persons: a supervisor, three data entry operators, and an operator for importing regional data and producing reports. There were four computers available: three for data entry and one for importing data and producing reports. The supervisor maintained a log book listing all precincts. This was used to record receipt of a faxed or original precinct protocol. The supervisor also was responsible for orderly filing of protocols after they were entered into the computer.

Phase 1 – Production of preliminary results
It is desirable to begin reporting preliminary results as quickly as possible after the polls close. The first source of data the CEC had access to were faxed protocols from the regions, so these should be entered immediately upon receipt. However, it was anticipated that diskettes from the regions would begin to arrive with original protocols before all faxes are received, and that, due to the poor quality of phone lines, some regions might be unable to fax any protocols. Therefore, as diskettes were received, they were imported immediately. Reports of preliminary results were based on all data from both faxes and diskettes. In instances where precinct results had been entered twice – once from faxed protocols and once by importing from diskette – the reporting program resolved the double entry by using the data from the diskette (which was presumed to have a higher probability of accuracy since it had already been validated by double-entry).

Handling faxes and original protocols
When a fax was received, the supervisor checked the log book to determine whether results had already been received from a precinct. Anticipating the possibility that some precinct data might be faxed more than once due to bad phone connections and/or confusion in the faxing procedures, it was the responsibility of the supervisor to see that each protocol was only processed once by the data entry staff. If an attempt was made to enter data from a precinct more than once, the data entry program would indicate that data already exists and only allow editing of that data. However, this could unnecessarily slow down the data entry process, so the supervisor was instructed to carefully track the receipt of protocols and only send them to data entry once.

Before all protocols were received by fax, original protocols began arriving from the regions accompanied by data diskettes. The same process was followed for each original protocol received from the regions. For each original protocol, the supervisor would first check the log book to determine whether the results had already been received by fax.

If a protocol had already been received from the precinct either by fax or original, the supervisor would put the protocol in the "completed" file. If not, the supervisor recorded the time of receipt in the log book, then gave the protocol to the first available data entry operator.
The data entry operator entered the following information from the protocol:

- Total number of voters, based on the lists of voters
- Number of voters registered and receiving ballots, based on the signatures
- Number of ballots given to the precinct electoral commission
- Number of canceled ballots
- Total number of valid ballots corresponding to approved specimen present in the ballot box
- Number of ballots recognized as invalid
- Number of ballots not corresponding to approved specimen
- Number of ballots voted against all candidates
- Number of votes given in favor of each candidate
- Total number of votes given in favor of candidates

After entering this data, the computer operator would give the protocol back to the supervisor to be filed in an orderly fashion with the other protocols.

Importing data from diskette
As diskettes arrived from the regions, they were given immediately to the computer operator responsible for importing the data. This operator ran the data import program provided by Armentel. After each import operation, the operator ran a new report of preliminary results and delivered it immediately to the chairperson of the CEC. This report included data from all precincts which had been received. The report provided a summary from all diskettes, plus data from any precincts which had been entered by the CEC but had not yet been received on diskette. The report also included a disclaimer that all reported numbers represent preliminary results which have not yet been verified as well as the number of precincts reporting.

Phase 2 – Production of final results
Before final results are announced, three different sources of data were compared:

- All regional data as imported from diskette
- All precinct protocols as they were entered by the CEC operators
- All community protocols as entered by the CEC operators indicating the number of ballot coupons counted from each precinct

The process of entering data from the first two sources has already been described; this process should continue until all diskette data has been imported and all precinct protocols have been entered by CEC. When all data had been entered and imported, the import and reporting operator would run the Validate program, which compared data from the regional diskettes with data entered by CEC operators. If the report indicated obvious data-entry errors on the part of CEC operators, CEC data should be corrected. Any other discrepancies would be taken to the chairperson of the CEC for reconciliation, and corrections made according to the chairman's decisions.

After both of these were completed, the data entry operators entered data from the community protocols using the data entry program provided by Armentel and the import and reporting operator ran a final audit report. This report showed all discrepancies between the number of ballots reported by the precincts and the number of coupons in the box as counted by the communities. Again, any discrepancies which were not due to obvious data entry errors by CEC operators were to be reported to the CEC chairperson and resolved according to his decisions and instructions.

When all discrepancies were resolved, the import and reporting operator produced a "Final Results" report, which was the basis for the CEC's official protocol announcing election results.

Phase 3 – Publishing the results
After the final results were announced, CEC data processing staff scanned all original protocols from precincts and from communities. These images, along with a final detail report showing the vote count from every precinct, with regional and national totals, were published on a CD-ROM. Armentel agreed to assist in the production of the CD-ROMs, with IFES coordinating the efforts of both CEC and Armentel.

The CD-ROM included all details from the precincts, with regional and national totals. The CD-ROM also included graphic images of the handwritten protocols. A copy of the CD-ROM was made available to all candidates' proxies and all international observers, allowing them to do their own comparisons between the handwritten precinct protocols, the data from each precinct, and reported totals. Results were also published on the official CEC website.

Electronic Voting

The variety of methods available to allow a voter to record his or her preference has grown dramatically over the past two decades. E-voting, or electronic voting, describes a number of different technologies that allow the voter to record this preference electronically as opposed to mechanically, including marking with pen or pencil or punching holes in the ballot. Broadly speaking, this includes:

- *DRE, or direct recording electronic systems* – DRE systems typically use either a dedicated push-button device or a touch-screen, and may or may not include a paper copy of the marked ballot (commonly known as VVPAT, or voter-verified paper trail

> *"Among those who consider such [e-voting] systems an improvement, there is still debate about whether the degree of improvement is enough to justify the cost."*

- *OMR, or optical mark recognition scanners* – capable of "reading" a paper ballot marked with pen or pencil (there is some debate over whether OMR systems fall under the category of e-voting)

- *Digital pen devices* – that detect where on the page the voter makes a mark

- *Internet voting systems* – that allow the voter to enter a preference via a web page. (These can be offered either directly to the user's home or office computer, or through a "closed network" that requires the voter to vote on a dedicated system in a secure physical area.)

The Debate

A number of experiences with e-voting in the past decade have changed expectations and framed the debate over whether e-voting systems are a step forward or backward. Among those who consider such systems an improvement, there is still debate about whether the degree of improvement is enough to justify the cost.

Proponents point to benefits such as increased accessibility that e-voting machines can offer to persons with disabilities, a possible increase in voter turnout, and decreased opportunity for fraud or error by election workers who count votes and fill in counting and tabulation forms. Opponents criticize a lack of transparency, the difficulties in creating bug-free software, security vulnerabilities, and opportunity for an election to be manipulated by a small number of persons or even by a single individual. In less developed countries, there are also concerns about lack of adequate infrastructure to support electricity and communication requirements and improper storage facilities that subject equipment to environmental extremes.

Certain e-voting systems have been rejected by the Netherlands, Germany, and Ireland, to name a few, while countries such as Venezuela, Brazil, and Estonia have had successful national elections using e-voting.

The debate is not likely to be resolved in the near future. The industry potential represents billions of dollars over the next decade, a major draw for technology vendors (New York City alone awarded a contract valued at USD $50 million for an E-voting system in January 2010).[29]

29 City Selects Company for New Voting Machines, David W. Chen, New York Times, January 5, 2010

Implementation details – Voting System Lifecycle
Both of the case studies presented here show the importance of viewing technology implementation from a lifecycle perspective. Systems can fail due to inadequate attention at any stage of implementation. In testimony to the House of Representatives, the U.S. Government Accounting Office (GAO) provided a good overview of the voting system lifecycle:

"Like any information technology product, a voting system starts with the explicit definition of what the system is to do and how well it is to do it. These requirements are then translated into design specifications that are used to develop the system...During the development, acquisition, and implementation of the systems, a range of tests are performed and the process is managed to ensure performance expectations are met. Together, these activities form a voting system lifecycle."[30]

Although the GAO view is heavily influenced by the structure of electoral administration in the United States it is still a useful starting point for understanding the process of implementing a new E-Voting system. The lifecycle includes three distinct phases:

1. System development – includes everything from the initial vision of how the system works, through availability of a completed product. This phase may happen in conjunction with legislative review, public hearings, budgeting, etc.; when a custom system is developed in response to specific needs of the target country, or it may happen in the isolation of a vendor's laboratory. Development includes identification of requirements, selection and/or creation of hardware components, selection and/or creation of software components, and system integration.

2. The acquisition process – varies depending on the country's procurement laws, but generally includes reaching consensus on requirements, issuing a request for bids, pre-evaluating vendors, evaluating bids, awarding a contract, and certifying equipment as meeting contractual requirements.

30 GAO-07-576T, a report to the Subcommittee on Financial Services and General Government, Committee on Appropriations, House of Representatives, March 7, 2007

3. The operations phase – involves many activities. Staff must be trained to operate and manage equipment. Chain of custody procedures must be defined and carefully monitored. Physical security and adequate environmental controls must be provided for machines during storage, transportation, and use. Rooms may need to be built and/or heating and cooling systems installed to provide adequate operating environments. The operations phase also includes interactions with political party agents and observers while balancing the requirement for adequate access to the process with security for the system.

As represented in the lifecycle diagram (Figure 8)[31], standards, testing, and management are critical throughout all three phases of the lifecycle.

Standards documents seek to provide uniform guidance in implementing a new system, based upon existing and emerging sets of "best practices." Development of voting technology does not happen in a vacuum, but rather is an evolution of hundreds of years of voting methods. Through countless experiences of good and bad voting practices a set of basic principles has emerged to guide election administrators and observers, as well as voters, in determining what is and is not acceptable to guarantee the accuracy and secrecy of the vote. The introduction of electronic voting has rapidly accelerated the pace of change in options available to capture voters' choices. Organizations concerned with credible democratic practice are racing to keep up with evaluating these choices and defining new sets of standards to guide the implementation of new voting systems. These standards documents must cover not only how voters will use the new systems, but how the systems will be developed and tested, what is acceptable practice for procurement, minimal levels for performance of the systems, how they will be stored and maintained, etc.

31 Ibid.

The United States has been working on standards for e-voting since the mid-1970s and published a set of *Voluntary Voting System Guidelines* (VVSG) in 2005, which were revised in 2009.[32] The Council of Europe issued a set of recommendations in 2004[33] that are much less comprehensive than the VVSG, but seek to align e-voting with the fundamentals of democratic elections as defined in existing documents and instruments executed by the United Nations, OSCE, the European Union, and others (e.g. "Universal Declaration of Human Rights").

In order for standards documents to be useful and effective they must specify functional requirements (what the system must do), as well as performance requirements (minimum verifiable levels of accuracy, speed, reliability, security, etc.) They must also clearly define how systems can be tested and certified as being in compliance. In order for a standards document to be most effective for guiding e-Voting systems, it must also be mandatory. Neither the U.S. nor the CoE documents meet all these criteria (the 10-page CoE document is too general and the more detailed 598-page U.S. document is, by definition, voluntary). However, each provides a much better framework for making progress than the absence of any standards documents. The standards should be used as a guide throughout the entire *development-acquisition-operations* process.

At every stage, there is a need for rigorous testing to ensure compliance with existing standards documents, requirements in procurement documents, and existing laws.

An overall management strategy is needed to ensure that the development is completed on schedule, and that it meets all specifications, guides delivery schedules, ensures all compliance testing, plans for adequate training of election officials and voters, monitors security requirements, and plans for safe storage of systems when not in use.

32 "Voluntary Voting System Guidelines, draft version 1.1, Summer 2009, http://vvsg.eac.gov/vvsg1.1/

33 "Recommendation Rec(2004)11 of the Committee of Ministers to member states on legal, operational and technical standards for e-voting", (Adopted by the Committee of Ministers on 30 September 2004 at the 898th meeting of the Ministers' Deputies), http://www.coe.int/t/e/integrated_projects/democracy/02_activities/02_e-voting/01_recommendation/00Rec(2004)11E_rec_adopted.asp

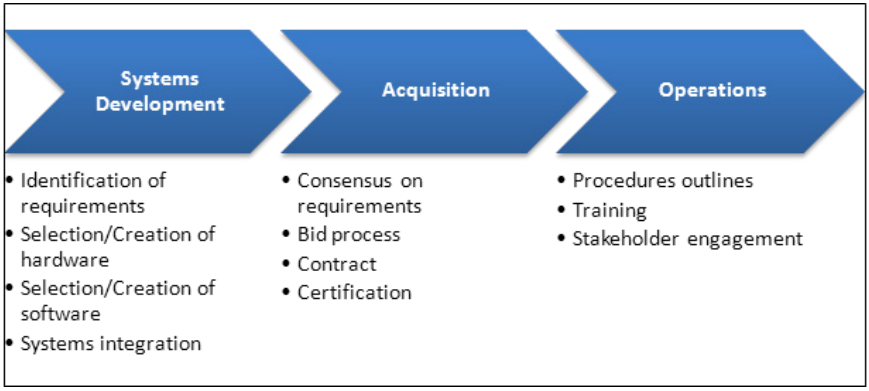


Figure 8 - Data Flow Diagram

Case Studies – the Contexts

The two case studies presented here represent different levels of success (or failure) of national attempts to implement e-voting. Kazakhstan's system has evolved over a period from 2003-2007, and brings together a large number of corporate providers to create a solution initially envisioned by United Institute of Informatics Problems in Belarus. The Ireland example, developed over a period from 1998-2004, was initiated by a government department responsible for electoral legislation.

Both countries faced allegations of some procurement irregularities. Ireland was a blatant failure of implementing an e-voting system, while Kazakhstan's implementation was a limited success. (In spite of offering a working system to voters, only 14% of voters who were given an option chose to vote electronically in 2005, and this number dropped to 6% in 2007.) These two countries were selected for this study, not to focus on lack of success but to highlight issues faced in developing and advanced countries. The purpose of this study is not to make a judgment about the advantages and disadvantages of e-voting, but rather to focus on lessons learned in how to maximize the probability of successful implementation of technology.

Kazakhstan: The Sailau E-Voting System

Douglas W. Jones[34]

Background

Kazakhstan declared its independence from the Soviet Union in 1991, after what was, effectively, two centuries of Russian colonial rule. Initially, there were a large number of parties, most of them very small, but by 2002 the number of parties fell to seven. By 2005, five parties offered presidential candidates.[35] While subject to some changes, the post-Soviet Kazakh electoral system is relatively simple, with direct election of the president and local council (Maslikhat) members and party-list election of the lower house of parliament (the Majilis). There are typically only a small number of selections in each race, and only a small number of races combined in each election.

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34 This material is based, in part, upon work supported by the National Science Foundation under Grant No. CNS-052431. The Organization for Security and Cooperation in Europe Office for Democratic Institutions and Human rights supported the author's participation in the 2005 and 2007 election observing missions in Kazakhstan. Any opinions expressed here are those of the author and are not endorsed by the National Science Foundation, the Organization for Security and Cooperation in Europe or the University of Iowa.

35 Lidia Karmazina, Institutionalization of the party system in the Republic of Kazakhstan: Past and Present, *Central Asia and the Caucasus*, 5(53), 2008. http://www.ca-c.org/journal/2009-01-eng/13.shtml

It is fairly easy to justify some degree of automation in elections where voters may select between hundreds of candidates, as in parliamentary elections in the Netherlands, or where voters vote in large numbers of races on a single ballot, as is common in the United States. In these cases, the complexity of the election makes hand counting difficult and clerical errors likely. Since Kazakh elections are simple, voting machines cannot be easily justified on these grounds.

Even in the 19th and early 20th centuries, a second reason for election automation was understood. Mechanized voting machines take control away from local election officials.[36,37] This transfers responsibility from local election officials to the technicians who design and maintain the machines and the officials who oversee them. When there is widespread local corruption, this centralization can be a powerful reform tool, but if the central authorities are not trustworthy, it can be dangerous.

The original ideas for the Kazakh Sailau (Сайлау) voting system have their origins in an electronic government project undertaken at the United Institute of Informatics Problems of the National Academy of Sciences of Belarus. Prior to 2003, a group at this institute explored the combination of electronic voter lists with bar-code scanning technology. In 2003, in partnership with the Kazakh Central Election Commission, they began developing this into a practical voting system.[38,39]

36 Republicans Carry Lockport: The New Voting Machine Submitted to a Practical Test, *New York Times*, April 13, 1892. http://spiderbites.nytimes.com/free_1892/articles_1892_04_00001.html

37 Joseph P. Harris, *Election Administration in the United States*, Brookings Institution, 1934, Pages 259, 261. http://vote.nist.gov/election_admin.htm

38 S. Ablameyko and V. Lipen, Electronic Voting System: Experience of Creation and New Projects, Eastern Europe e-Gov Days, 2007: Best Practice and Innovation, April 11-13, Prague. http://uiip.bas-net.by/eng/lab214/img/Session5A_Lipen.pdf

39 Липень Виталий Юльянович (Vitaly Yulyanovich Lipen) and Увалиев Самат Альмахынович (Samat Almahynovich Uvaliev) , Система Электронного Голосования (Electronic Voting System), Eurasian Patent Organization patent 006712, granted February 24, 2006. http://www.eapo.org/rus/reestr/patent.php3?id=6712

The project was incubated by the Central Election Commission, under Kuandyk Turgankulov. President Nursultan Nazarbayev endorsed this development in 2004. In March 2004, the election law was amended to permit electronic voting.[40] The Sailau electronic voting system was first deployed in Kazakhstan in the September 2004 parliamentary elections,[41] and has remained in use, with significant modifications, in subsequent elections.[42,43]

In Kazakh documents, the Kazakh electronic voting system is generally referred to as the Automated Information System «Sailau» (АИС «Сайлау»»or AIS «Sailau»). As the word sailau means election in Kazakh, calling it the Sailau electronic voting system is redundant. Nonetheless, the latter usage has become established. The system we describe here is the touch-screen voting system deployed in 2005 and 2007; we will largely ignore the aspects of the 2004 prototype that were abandoned in later elections, notably the bar-code reader used for voter input. It should be noted that the replacement of this bar-code reader with a touch-screen voting terminal in the voting booth had little effect on the rest of the system.

The *Sailau* voting system

The Kazakh Sailau electronic voting system might best be described as an indirect-recording electronic voting system. In a direct recording voting system, a single mechanism is used both to capture the voter's intention and to record or tabulate the voter's ballot. In contrast, in the Sailau system and a small number of similar systems, separate mechanisms are used for these two functions. In such systems, the voting terminal used in the voting booth records votes on a token that the voter then carries to an electronic ballot box.

40 *Sailau Electoral Information System*, Kazakh Central Election Commission web site. http://e.gov.kz/wps/portal/Content?contentPath=/library2/3_vlast/elections/article/473&lang=en

41 *Republic of Kazakhstan Parliamentary Elections 19 September and 3 October 2004,* OSCE/ODIHR Election Observation Mission Report, Warsaw, December 15, 2004. http://www.osce.org/item/3997.html

42 *Republic of Kazakhstan Presidential Election 4 December 2005,* OSCE/ODIHR Election Observation Mission Final Report, Warsaw, February 21, 2006. http://www.osce.org/item/18133.html

43 *Republic of Kazakhstan Parliamentary Elections 18 August 2007,* OSCE/ODIHR Election Observation Mission Report, Warsaw, October 30, 2007. http://www.osce.org/item/27638.html

A second feature of the Sailau system is the integration of pollbook functions with voting functions. Kazakhstan has a system of universal national identification cards that include a bar code. The Sailau voting system integrates a national-scale distributed voter database, with provisions to scan ID cards, check them off in the voter database, and issue ballots to voters, without any need for paper records or signatures.

Both indirect-recording electronic voting systems and electronic pollbooks have a long history. Before continuing with discussion of the Sailau system, we will discuss some comparable systems.

Indirect recording electronic voting systems

Indirect recording electronic voting systems are similar to paper ballot systems, except that voters do not directly mark their ballots. Instead, voters use a ballot marking machine of some kind before carrying the marked ballot to a ballot tabulating machine. Urban G. Iles patented a punched-card voting system that conformed to this model in 1893.[44] The Votomatic punched card system[45] formerly in widespread use in the United States is similar, particularly if used with a precinct-count tabulating machine. The similarity is most pronounced when ballot marking is done using an electronic device such as the Automark[46] to mark paper ballots that are then fed into a precinct-count ballot tabulator such as the ES&S Model 100.[47]

All of these systems offer voters the opportunity to directly inspect and check the records of their votes. In contrast, as with direct-recording electronic voting systems, a pure indirect-recording electronic voting system does not permit voters to directly inspect the records of their votes. In 1993, Texas Instruments patented an indirect-recording electronic voting system.[48] To vote on this system, voters were to be issued bar-coded paper tickets. The voter would then insert this ticket in a touch-screen voting terminal to begin voting. At the end of the voting session, the terminal would print the votes on the ticket as an additional bar code. To cast the vote, the voter would then drop the voted ticket through a tabulating bar-code reader into a ballot box.

44 Urban G. Iles, *Ballot-Registering Device*, U.S. Patent 500,001, June 20, 1893. http://patft.uspto.gov/netahtml/PTO/srchnum.htm

45 Joseph P. Harris, *Data Registering Device,* U.S. Patent 3,201,038, Aug. 17, 1965.

46 Eugene M. Cummings, *Ballot Marking System and Apparatus,* U.S. Patent 7,080,799, July 25, 2006.

47 Steve Bolton, Tim Cordes and Herb Deutsch, *Method of Analyzing Marks Made on a Response Sheet,* U.S. Patent 6,854,644, Feb. 15, 2005.

48 Julien Anno, Russell Lewis and Dale Cone, *Method and System for Automated Voting*, U.S. Patent 5,189,288, Feb. 23, 1993.

The first indirect-recording electronic voting systems to be deployed were the Belgian *Jites* and *Digivote* systems.[49] These systems closely parallel the Texas Instruments patent, except that data is recorded on the tickets using a magnetic stripe instead of the bar codes proposed in the Texas Instruments patent.

Bruck, Jefferson and Rivest coined the term "frog" as a technology independent term to describe the medium used to carry the voted ballot from the vote recording component of a voting system to the electronic ballot box or vote tabulation system.[50] To use their terminology, the magnetic card used in the Belgian voting systems, the bar-coded paper ticket in the Texas Instruments patent, and punched-card paper ballots can all be described as frogs.

A central feature of frog-based voting systems is that they can offer transparency and re-countability comparable to that of conventional paper ballots if voters and election auditors can independently verify the contents of frogs without use of tools provided by the electoral authority. When votes recorded on the frog are not directly readable, Bruck, Jefferson and Rivest proposed that voters or independent election monitoring groups could provide frog reading machines to allow voters to verify that their ballots are correctly recorded. This requires that, once a frog is recorded, it becomes a read-only device, and it requires that the election authority disclose all details of the data formats used on frogs.

Electronic Pollbooks

In general, an electronic pollbook serves to replace or supplement the use of paper voter lists and pollbooks at the registration table in a polling place. In a conventional polling place, election workers spend a considerable amount of their effort looking up voters in paper voter lists or pollbooks. An electronic pollbook maintains the voter list as a database. Poll workers either enter voter names on a keyboard or electronically read voter ID cards. In some cases, electronic pollbooks capture voter signatures on a graphics input device, in some cases, multiple pollbooks can be connected by a computer network; and in some cases, electronic pollbooks integrate closely with the voting machines used at the polling place.

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49 *Expert Visit on New Voting Technologies: 8 October 2006 Local Elections, Kingdom of Belgium,* OSCE Office for Democratic Institutions and Human Rights, no date. http://www.osce.org/item/22177.html

50 Shuki Bruck, David Jefferson and Ronald Rivest, *A Modular Voting Architecture ("Frogs"),* VTP Working Paper #3, Caltech/MIT Voting Technology Project, August, 2001. http://www.vote.caltech.edu/drupal/files/working_paper/vtp_wp3.pdf

In 1996, US-based I-mark Systems developed an electronic pollbook for use in conjunction with their Electronic Ballot Station, the direct ancestor of the Premier AccuVote TS. Voters were expected to identify themselves to pollworkers, who would check off names on the electronic pollbook, using it to issue each voter a smart-card that served as a token permitting one ballot to be cast on one of the associated voting machines. These early electronic pollbooks were autonomous; each held only the voter list for one polling place and there was no provision for networking. A voter using I-mark electronic pollbook and their Electronic Ballot Station would have a voting experience very similar to a voter using the Sailau system, but the internal architecture of these two systems are quite different.

In this century, several other vendors have brought out electronic pollbooks. Some of these do not interface with the voting system, such as the systems from Datacard.[51] Others such as the systems from TruVote[52] and Premier Election Solutions[53] integrate closely with the voting system. Yet others, such as that from ES&S,[54] offer optional linkage to the voting system.

The Sailau Architecture

Voting systems are seen from several perspectives, and their architecture is best described from the perspective of each class of users. In the case of the Sailau system, three classes of users are paramount: voters, poll workers, and system administrators.

Voter's perspective

A voter entering a polling place using the Sailau electronic voting system follows a path that is quite similar to the path at a polling place using conventional paper ballots.[55] The voter checks in at a registration table, where a ballot is issued to the voter. The voter then carries this ballot to a voting booth,

51 *Datacard Electronic Poll Book Solution,* Datacard Group, 2005, http://www.datacard.com/downloads/ViewDownLoad.dyn?elementId=repositories/downloads/xml/EPB_Datasheet_050809.xml&repositoryName=downloads&index=2

52 *TruVote Software, Operating and Data Base System and System Security,* TruVote International, no date. http://www.truvote.com/TruVoteDocs/TruVoteStuctureAndSecurityVersion2.pdf

53 *ExpressPoll 5000 Automated Voter Verification Solution,* Premier Election Solutions, no date. http://www.premierelections.com/documents/product_sheets/expresspoll_5000.pdf

54 *The intElect Electronic PollBook From ES&S,* Election Systems and Software, no date. http://www.essvote.com/HTML/docs/ess_electronic_pollbook.pdf

55 Паспорт Автоматизированной Информационной Системы "Сайлау" *(Passport Automated Information System "Sailau"),* Central Election Commission, Republic of Kazakhstan, Astana, 2007, Section 5.1.1. http://election.kz/docs/ais_saylau.rar

votes on the ballot, and returns the ballot to the ballot box before leaving the polling place. While the overall flow is familiar, each step outlined above involves interaction with the Sailau system.

Every voter in Kazakhstan has been issued a national ID card that includes both photo identification and a machine-readable bar code. Each polling place equipped with the Sailau electronic voting system has a bar-code reader at the registration table. Where a conventional polling place requires the voter to sign a pollbook, voters using the electronic voting system merely wave their ID card under the bar code reader. The computer at the registration table then looks up the ID card in the voter database, issues an electronic ballot, and marks that the ballot has been issued to that voter. The ballot is issued by recording it onto a smart card.

The smart card used to hold the ballot is a card the size of a credit card that incorporates a small microprocessor and a flash memory. The voter carries this card from the registration table to the voting terminal in the voting booth. When the card is inserted in a slot in the voting terminal, the terminal displays the ballot on a small touch screen display. If there is more than one race on the ballot or more than three candidates per race, the ballot display involves multiple screens.

At the end of the voting session, the voter is offered the opportunity to verify that the ballot was properly recorded. Voters accepting this offer are issued a random 4-digit control number before the votes are recorded on the smart card.[56] A voter wishing to complete the voter verification process must return to the polling place after the polls close and check that this number is correctly reported.

Having voted, the voter carries the smart card from the voting terminal back to the registration table and inserts it into the slot in the smart card reader. This records the ballot in the electronic ballot box and allows the card to be reused for another voter's ballot. This use of smart cards comes very close to the frog model discussed above, except that the election authority has not disclosed full details of the data format used on the smart card.

56 *Electronic Voting Chart,* Central Election Commission, Republic of Kazakhstan, Astana, 2007. http://election.kz/portal/page?_pageid=153,75206&_dad=portal&_schema=PORTAL or http://election.kz/img/shema-rus.jpg

At the end of the day, after the polls are closed, the computer at the registration table prints out several reports. One of these reports lists the 4-digit control numbers that were issued to those voters who opted to verify their ballots. The control numbers on this report are sorted by race and selection, so voters can easily check that their number is listed by the correct candidate or party. Complete end-to-end verification of an election requires that a sufficient number of voters check on the correctness of their control codes at the close of the polls, and that, for each polling place, members of the public note the polling place totals and compare these with the official totals for that polling place that were added to the national totals.

Poll worker's perspective

Each polling place is equipped with one computer system for use at the registration desk, as well as one voting terminal for each of several voting booths plus a stack of smart cards to be used as ballot carriers. From the perspective of polling place setup, assembly of the computer system at the registration desk is a major job, involving attaching the keyboard, display, printer, modem, bar-code reader, and smart-card base. This must be completed three days before the election.[57] Once this is set up and tested, a USB device (resembling a common USB memory stick) is attached to the computer to start the voting application. The USB device is a Belarussian product, the Enigma (Знигма) CryptoKey, also known as the ∏-card.[58]

The polling place computer used with the Sailau system is sufficiently complex that each e-voting polling place has a technician assigned to it in addition to the statutory precinct election committee.[59] The technician is responsible for setting up the computer system, while the precinct election committee has statutory responsibility for all election-related activity at the polling place.[60]

57 *Constitutional Law of the Republic of Kazakhstan,* Chapter 9-1, Article 50-1, Paragraph 5, amended June 2007. http://election.kz/docs/zakon.doc

58 *Enigma CryptoKey 2001,* Знигма (Enigma). http://www.enigma.by/apparat-enigma.html

59 *Constitutional Law of the Republic of Kazakhstan,* Chapter 9-1, Article 50-3, Paragraph 2.

60 *Constitutional Law of the Republic of Kazakhstan,* Chapter 2, Article 18.

With many electronic voting systems, there are serious questions about chain of custody for the voting equipment. The Sailau system addresses these issues in two ways. First and foremost, the Sailau voting terminal is a very simple fixed-program device. It does contain a small microprocessor, but the program has read-only memory and need not be modified from one election to the next. The only election specific information available to the voting terminal is provided by the smart card carrying the electronic ballot. Thus, the voting terminal is not exposed to the invasions and consequent security vulnerabilities most direct recording electronic voting systems face before each election.

It is instructive to contrast the Sailau voting system with cosmetically similar smart-card based voting systems such as the Diebold/Premier AccuVote TS system.[61] In both of these systems, the voter, on checking in at the registration desk, is issued a smart card that is used to begin a voting session. With the AccuVote TS system, the smart card carries only authorization, while with the Sailau system, the card carries the ballot itself. After voting with both of these systems, the voter returns the smart card to the registration desk. The AccuVote TS voting machine itself records the votes and the only reason to return the card is to allow its reuse. The card carries no useful information. In contrast, with the Sailau voting terminal, the card carries the voted ballot and the terminal forgets everything between voting sessions. Thus, under normal circumstances, the Sailau voting terminals are comparatively trivial to test and require minimal effort to set up before each election.

The second feature that, to some extent, simplifies the software authentication question is the CryptoKey issued to each polling place. This device is prepared by the Central Election Commission (CEC), and when it is inserted in the polling place computer system, the system makes a connection, by modem, to a server controlled by the CEC. Public key cryptography is used, so we have reasonable assurance of the integrity of the communication path.

Once this communication path is established, all election specific information, including both a template for the ballots and the voter list are downloaded to the precinct. This download is done using commercial, off-the-shelf distributed database technology so that simple database queries extract the precinct voter list and the relevant candidate list or lists.

61 Tadayoshi Kohno, Adam Stubblefield, Aviel D. Rubin, Dan S. Wallach, Analysis of an Electronic Voting System, *IEEE Symposium on Security and Privacy, Oakland, CA, May, 2004.* *http://avirubin.com/vote/analysis/*

At the close of the polls, before any ballots are examined (either electronic or paper), the Precinct Election Committee is required to announce the number of voters who have voted at the precinct.[62] To simplify this, the polling-place computer for the Sailau system incorporates a large display giving the number of electronic ballots that have been issued and the number of ballots that have not yet been returned.

At the close of the polls, the polling-place computer system prints out several reports. One of these, printed in duplicate, is the official "results protocol," a document listing each race on the ballot and the number of votes for each candidate. A copy of this is posted at the polling place and copies are given to each election observer who requests one.[63] At the close of the polls, as well as several times during the day, the polling-place computer system makes modem connections to the server. The final connection is made after the Precinct Election Committee approves the precinct election results and they are recorded, with electronic signatures, on the CryptoKey. At this point, the distributed database mechanisms automatically incorporate the election results and updated voter lists into the central database.

Kazakh laws give the electronic record stored on the CryptoKey priority over all other records.[64] The results are recorded on the same USB device that is used to distribute the security keys.[65] This device is considered as evidence in any appeal of the results,[66] and it must be retained from for one year after the election.[67]

62 *Constitutional Law of the Republic of Kazakhstan,* Chapter 8, Article 43, Paragraph 3-1.
63 *Constitutional Law of the Republic of Kazakhstan*, Chapter 9-1, Article 50-6, Paragraphs 2-3.
64 *Constitutional Law of the Republic of Kazakhstan,* Chapter 9-1, Article 50-7, Paragraph 1.
65 *Constitutional Law of the Republic of Kazakhstan,* Chapter 9-1, Article 50-6, Paragraph 1.
66 *Constitutional Law of the Republic of Kazakhstan*, Chapter 9-1, Article 50-8.
67 *Constitutional Law of the Republic of Kazakhstan,* Chapter 9-1, Article 50-9.

System Administrator's Perspective

The system administrator for the voting system sees it as a distributed database system.[68] The central server is in a secure area of CEC Headquarters in Astana. This is linked by dedicated communications lines to regional servers.[69,70] The regional servers are located in each oblast or equivalent administrative unit, typically on the premises of the corresponding regional election committee. The server hardware and database system are provided by Todes (Тодес), a Belarussian partner of HP.[71]

The database includes the national voter list, the list of races in the election, the list of candidates for each race, and geographic coding sufficient to identify which voters are assigned to which polling places and which races apply to each polling place. It should be noted, however, that Kazakh absentee voting rules allow voters to vote at the polling place nearest their current residence using an "off the register certificate" issued at the polling place.[72] As a result, the electronic voting system must allow voters to vote at polling places where they are not registered, and there is a possibility that a dishonest voter will vote several times. This can be detected at the close of the election when the lists of voters from each polling place are consolidated.

Long before the election, the system administrators must create the public-key infrastructure for the voting system.[73] This involves using the server at the CEC to initialize one CryptoKey device for each polling place. After initialization, these must be distributed to the polling places. These keys, while small, contain an embedded microprocessor as well as flash memory; in principle, this could make it impractical for a machine to open the contents of the CryptoKey without first connecting to the Central Election Commission, and it should make it impractical to impersonate a precinct's computer system without using the authorized CryptoKey.

Because of the centralized network connecting all precincts during opening and closing the polls, it is easy to centrally monitor the extent to which polling places have technical difficulties with opening or closing the polls. On the other hand, it exposes polling places to potential difficulties if electrical

68 Паспорт *(Passport)*, Section 8.
69 *Constitutional Law of the Republic of Kazakhstan,* Chapter 9-1, Article 50-2, Paragraph 3.
70 *Constitutional Law of the Republic of Kazakhstan,* Chapter 9-1, Article 50-7, Paragraph 1.
71 Тодес Продукты (Todes Products). http://www.todes.by/ru/products.html
72 *Constitutional Law of the Republic of Kazakhstan*, Chapter 7, Article 41, Paragraph 6-1.
73 Паспорт (Passport), Section 7.

systems or communication lines fail. Kazakh law requires that these be reliable,[74] but legal requirements cannot be relied on in the face of natural events such as storms.

A voting system could be constructed where the central machine was directly connected to the Internet, so that election results are immediately visible on a web site as the results come in. This would pose dangerous security problems because it would expose the central system to attacks from the web. To avoid this, the central server of the Sailau system is isolated from the Internet by an air gap. That is, there is no direct connection. Any import or export of data between the Internet and the central server must be done by hand.[75]

The Acquisition Process

As mentioned above, the available public record makes it clear that the original conception for what became the Sailau system came from workers at the United Institute of Informatics Problems in Minsk, Belarus.[76] The institute and the Kazakh Central Election Commision cooperated in continued development through the end of 2003, and on 4 March 2004 there was a public demonstration of the new system. By this time, the estimated cost of using the system nationwide was 4.2 billion Kazakh tenge (about USD $30 million).[77] Legislation authorizing the use of electronic voting was only passed in April 2004.[78] This law was adopted after an extended debate, with preliminary drafts distributed for public comment to organizations such as the OSCE in September 2003.[79,80] Unfortunately, the early drafts only included the briefest mention of electronic voting. It was only in March 2004 that substantial legislation dealing with electronic voting was inserted into the law by amendment.[81]

74 *Constitutional Law of the Republic of Kazakhstan*, Chapter 9-1, Article 50-1, Paragraph 6.

75 *RFC 4949 - Internet Security Glossary,* Internet Engineering Task Force Network Working Group, August 2007. http://tools.ietf.org/html/rfc4949

76 S. Ablameyko and V. Lipen, Electronic Voting System.

77 *News Bulletin No 10, March 8, 2004,* Embassy of Kazakhstan to Great Britain. http://www.kazembassy.org.uk/embassy_news_115.html

78 *Constitutional Law of the Republic of Kazakhstan*, Chapter 9.1, amendments signed into law April 14, 2004.

79 *Amended Law on Elections of April 2004 -- Key Reforms,* briefing paper, Republic of Kazakhstan, no date. http://www.kazelection2004.org/downloads/Briefing%20of%20the%20Amended%20Election%20Law%20of%202004.DOC

80 *Preliminary Assessment of the Draft Amended Election Law of the Republic of Kazakhstan,* OSCE ODIHR, Warsaw, September 19, 2003. http://www.osce.org/item/2580.html

81 *Republic of Kazakhstan Parliamentary Elections 19 September and 3 October* 2004, OSCE ODIHR, page 7.

The election law established a State Commission for Acceptance of the Electronic Electoral System, but the commission was only formally authorized on 14 September 2004.[82] This commission approved the use of the system on 15 September 2004.[83] This was just days before the 19 September parliamentary elections, where 961 polling places were equipped to use the system. The final scope of the first trial use was only decided on September 17, just two days before the election.

This timeline makes it quite clear that the development of the system was conducted in parallel with the development of the law governing the system, and that the decision to use the system was made in advance of the establishment of a legal basis for such use. This informal development process led to fiscal problems. The CEC incurred a 210% cost overrun in 2005 and was specifically cited for improper accounting for the acquisition costs for the Sailau system.[84] In addition, one contractor, Alsi (ТОО "Алси"), was fined for delayed delivery of some of the components of the Sailau system.

Because of the development environment in a region where there are ongoing changes in the relationships between government and private enterprise, it is not surprising that corporate involvement in the Sailau system is complex. Kazakhtelecom both provided dedicated communications lines to connect the system and conducted the initial acceptance testing.[85] A 2007 news release gave credit to the Agency for Information and Communication, Kazakh Telecom, Microsoft, and Oracle.[86] As already mentioned, key technology originated in Belarus, most notably, the Enigma CryptoKey. Another critical Belarussian contributor was Todes Ltd, which developed the Oracle database framework for Sailau. Todes is

82 О создании Государственной комиссии по приемке электронной избирательной системы *(Creation of a State Commission for the acceptance of electronic election system)*, Resolution of the Government of the Republic of Kazakhstan dated 14 September 2004, N 962. http://ru.government.kz/docs/p040962_20040914.htm

83 *Sailau Electoral Information System*, Kazakh Central Election Commission.

84 Отчет об исполнении бюджета Республики Казахстан за 2005 год (A report on the financial performance of the Republic of Kazakhstan for 2005), Счетным комитетом по контролю за исполнением республиканского бюджета (Accounts Committee for Control over Execution of the Republican Budget), Section 3.2, http://www.nomad.su/esep/b2005.html

85 *Sailau Electoral Information System*, Kazakh Central Election Commission.

86 Еженедельный информационный бюллетень сферы связи и информатизации (Weekly newsletter of Communications and Information), Центр науно-техночеких и маркетинговых исследований (Center for Science, Technology and Marketing Research), Tashkent, July 23-29, 2007, page 16. http://www.aci.uz/files/bulletins/WIB19%2023.07-29.07.2007.pdf

also listed as the copyright holder on most of the web pages of the Central Election Commission. Following the 2004 election, Delta Plus of Almaty developed the touch-screen voting terminal.[87]

Another complexity lies in the relationship between the Central Election Commission, the developers of the system, and the system administrators. When the same people both develop a system and then approve its use, there are many potential conflicts of interest. To avoid this, the CEC spun off its data processing center as a state owned enterprise, the Engineering Center of the CEC of the Republic of Kazakhstan (РГП "Инженерно-технический центр ЦИК Республики Казахстан"). The organization of this quasi-independent agency did not go smoothly.[88]

On paper, the certification and approval process used resembles that for electronic voting systems in the United States since the 1990s. Otan Security, an independent testing laboratory in Almaty, certified to the Central Election Commission that the system was in conformance with applicable standards, after which the system was approved for use. A more detailed analysis shows that the certification was done prior to a variety of changes in the system and that there is no requirement for recertification after such changes. Furthermore, the standards to which the voting system was tested prior to the election included requirements that remain a state secret.[89,90]

Practical Use of the Sailau System

The Sailau system was first used in a high-profile national election, without benefit of a pilot project. This may explain some of the suspicion expressed about the system by opposition parties. In its first use in 2004, the prototype version was used in 961 out of 9,480 polling places.[91] In the 2005 election, the new touch-screen version was used in 1,451 polling places. While this is only a small fraction of the polling places, the equipped polling places were largely in urban

87 *Republic of Kazakhstan Parliamentary Elections 18 August 2007,* OSCE/ODIHR, page 12.

88 Отчет об исполнении бюджета Республики Казахстан за 2005 год (A report on the financial performance of the Republic of Kazakhstan for 2005), Section 3.2.

89 *Republic of Kazakhstan Presidential Election 4 December 2005*, OSCE/ODIHR, page 29.

90 *Republic of Kazakhstan Parliamentary Elections 18 August 2007*, OSCE/ODIHR, pages 12-13.

91 *Republic of Kazakhstan Parliamentary Elections 19 September and 3 October 2004*, OSCE/ODIHR, page 8.

centers, so they served approximately 32 percent of the electorate.[92] In 2007, the number of polling places was expanded to 1,512, covering approximately 33 percent of the electorate.[93] Limiting the use of the system to urban polling places significantly reduced the likelihood of problems caused by unreliable power and communication lines.

The Sailau system was not imposed on voters. Rather, voters have always been given the option of using paper ballots or electronic ballots. Paper pollbooks have always been maintained, with voters signing the paper as well as using their ID cards to sign the electronic pollbook if they opted to use the Sailau system. This parallel system was not initially intended; rather, just three days before the 2004 election, the Central Election Commission offered this alternative as a response to concerns about the new system. Giving voters a choice at the polls and maintaining redundant paper records is strong insurance against any system failure, but it poses problems. It means that the polling place workers must manage two parallel election systems, and it raises the price of the election above what it would have been with either system alone.[94]

Before each election, the government undertook extensive public education efforts to explain the electronic voting system. The instructional materials provided to voters have all been placed on the web.[95] Noteworthy, among the materials, is a well-designed instructional poster that was placed at every polling place using the Sailau system.[96] Training for technicians and poll workers was also well designed, with operator training beginning in the month before poll worker training, and poll worker training well in advance of the election.[97] Well designed manuals were provided for poll workers,[98] district electoral

92 *Republic of Kazakhstan Presidential Election 4 December 2005,* OSCE/ODIHR, page 9.

93 *Republic of Kazakhstan Parliamentary Elections 18 August 2007*, OSCE/ODIHR, page 11.

94 *Sailau Electoral Information System*, Kazakh Central Election Commission.

95 *Sailau Electronic Voting System*, Kazakh Central Election Commission. http://election.kz/portal/page?_pageid=153,80988&_dad=portal&_schema=PORTAL

96 *Electronic voting chart*, Kazakh Central Election Commission, 2007. http://election.kz/portal/page?_pageid=153,75206&_dad=portal&_schema=PORTAL

97 *Press release*, Central Election Commission of the Republic of Kazakhstan, April 25, 2007. http://election.kz/portal/page?_pageid=153,529391&_dad=portal&_schema=PORTAL

98 *NOTICE To a member of the local election commission on elections of deputies of the Mazhilis of the Parliament and Maslikhats of the Republic of Kazakhstan*, Central Election Commission, 2007. http://election.kz/docs/chlenu-echastkov-kom-eng.doc

committees,[99] territorial electoral committees,[100] candidates,[101] and observers.[102,103]

Pre-election testing (sometimes called logic and accuracy testing) has long been recommended before the use of electronic voting systems.[104,105] Public pre-election testing for the 4 December 2005 presidential election began on 14 November, two weeks before the election.[106] These tests involved not only scripted sequences of test votes but also opening polling places for public demonstrations. Thus, the test period combined elements of a public relations campaign for the voting system with testing.

The communications architecture of the voting system allowed workers and observers at the Central Election Commission to monitor the opening and closing of the polls at polling places with electronic voting. In 2007, a single central observer was able to note that only three percent of the polling places equipped with electronic voting were not open by the start of Election Day at 7:00 am, and that almost all of

99 *Commemorative booklet for the member of district electoral committee on maslikhat deputies elections*, Central Election Commission, 2007. http://election.kz/docs/okruj-izbir-kom-eng.doc

100 *Instruction booklet for a member of territorial election committee for election of deputies of the Mazhilis of the Parliament and the Maslikhats of the Republic of Kazakhstan*, Central Election Commission, 2007. http://election.kz/docs/terizbircom_eng.doc

101 *What do Candidates for Deputies of Maslikhat, their Authorized Persons Need to Know about Elections,* Central Election Commission, 2007. http://election.kz/docs/Maslihat-kandidatu_Eng.doc

102 *Guideline on observation of the Senate deputies election of the Parliament of the Republic of Kazakhstan,* Central Election Commission, 2007. http://election.kz/docs/pamatka_nabludenia_senat_2008_eng.rar

103 *The reminder for observers of political parties, other public associations, non-commercial organizations, mass media representatives of the Republic of Kazakhstan at the elections of Majilis of the Parliament and masliakhats of the Republic of Kazakhstan*, Central Election Commission, 2007. http://election.kz/docs/nablyudatel-eng.doc

104 *Performance and Test Standards for Punchcard, Marksense, and Direct Recording Electronic Voting Systems*, United States Federal Election Commission, January 1990. See page xxi.

105 Roy G. Saltman, Accuracy, integrity and security in computerized vote tallying, *Communications of the ACM, 31*, 10 (October, 1988) see page 1189.

106 Introducing the Sailau e-voting system, *News release from the Permanent Mission of the Republic of Kazakhstan to the United Nations,* Geneva, November 11, 2005. http://74.125.95.132/search?q=cache:TRAquamvR84J:missions.itu.int/~kazaks/eng/news14.htm+sailau+legislation&cd=1&hl=en]

the problems were resolved by 7:30 am.[107] While the Central Election Commission did release approximately half of the Sailau system's Oracle database directly to OSCE observers, the public release remained limited. A preliminary breakdown giving vote totals for each of the 16 regions (oblasts and urban areas) was released based on the data available at 10:00 pm on election night.[108] Updated preliminary figures were released on the following day,[109] and final figures were released four days later, both in similar formats.[110]

Finally, nine days after the election, the Central Election Commission certified the winners.[111,112]

Controversy

From the start, there was significant opposition to the introduction of electronic voting in Kazakhstan. Opposition parties actively urged voters to vote on paper.[113,114] These opposition campaigns were symptomatic of a general lack of trust in the system. In the 2004 election, a second round of voting was required in some districts, and use of the electronic system fell from the first to second round.[115] In 2005, less than 14% of those who had the option to vote electronically did so.[116] A month

107 *Republic of Kazakhstan Parliamentary Elections 18 August 2007*, OSCE/ODIHR, page 25.

108 *On the preliminary results, News Release*, Central Election Commission web site, Aug. 18, 2007. http://election.kz/portal/page?_pageid=153,604861&_dad=portal&_schema=PORTAL

109 *The CEC announced preliminary results of election, News Release,* Central Election Commission, Aug. 19, 2007. http://election.kz/portal/page?_pageid=153,605104&_dad=portal&_schema=PORTAL

110 On the establishment and publication of the results of election, *Act of the Central Election Commission*, Aug. 22, 2007. http://election.kz/portal/page?_pageid=153,605758&_dad=portal&_schema=PORTAL

111 On the registration of the deputies, *Act of the Central Election Commission,* Aug 27, 2007. http://election.kz/portal/page?_pageid=153,609680&_dad=portal&_schema=PORTAL

112 *Elections of the Majilis 2007, News Release*, Central Election Commission, Aug 27, 2007. http://election.kz/portal/page?_pageid=153,511661&_dad=portal&_schema=PORTAL]

113 Kazakh parties call for rejection of electronic voting, *Kazakhstan Daily Digest,* Euasianet.org, May 21, 2004. http://www.eurasianet.org/resource/kazakhstan/hypermail/200405/0024.shtml

114 *Kazakhstan's Electronic-Voting System Challenged*, Radio Free Europe, August 16, 2007. http://www.rferl.org/content/article/1078191.html

115 *Republic of Kazakhstan Parliamentary Elections 19 September and 3 October 2004*, OSCE/ODIHR, page 9.

116 *Republic of Kazakhstan Presidential Election 4 December 2005,* OSCE/ODIHR, page 10.

before the 2007 election, polling data showed only 22 percent of the population preferred electronic voting.[117] In the election a month later, only about six percent of those who had the option to vote electronically did so.[118,119]

It should be noted that, in 1934, Joseph Harris observed that voting machines "have never been able to succeed if the voter is given his preference between voting on the machine and voting on a paper ballot."[120] While the circumstances in Kazakstan differ markedly from the situation in the United States in the early 20th century, this observation reminds us that it is easy to overestimate the importance of an anti-technology campaign. People have a natural distrust for technological alternatives they do not understand.

Some government actions have contributed to public distrust. On Election Day 2007 there were reports that the passwords for poll worker access to the Sailau system had been released.[121,122] The Central Election Commission's prompt reply to this complaint was that these were pre-election testing passwords and were not the same passwords used in the general election.[123] It would have been better if the passwords in question had never been revealed.

Partisan observers noted significant discrepancies between official results and results they observed at polling places.[124] Several observers noted, while the Central Election Commission's handling of complaints opened up

117 *Month before elections, 37: support Nur Otan, 20% NSDP* ,Interfax, July 17, 2007. http://www.interfax.kz/?lang=eng&int_id=10&function=view&news_id=1181

118 *Republic of Kazakhstan Parliamentary Elections 18 August 2007*, OSCE/ODIHR, page 25.

119 *Comments and remarks of Kazakhstan party to Statement of preliminary findings and conclusions The International Mission (ODIHR/OSCE, OSCE PA, PACE) on Election Observation Parliamentary Election, the Republic of Kazakhstan, 18 August 2007*, Central Election Commission, http://election.kz/portal/page?_pageid=153,621419&_dad=portal&_schema=PORTAL, section 6]

120 Joseph P. Harris, Election Administration in the United States, Brookings Institution, 1934, page 255. http://vote.nist.gov/election_admin.htm

121 *Appeal to CEC Chairman*, Democratic Party of Kazakhstan "Азат", August 18, 2007. http://eng.azat-party.info/activity/statements/2007/08/18/statements_2293.html

122 Oraz Zhandosov, *Letter to Kuandyk Turgankulov*, Aug. 18, 2007. http://election.kz/portal/page?_pageid=153,604805&_dad=portal&_schema=PORTAL

123 *The CEC RK answer to Oraz Zhandosov*, Central Election Commission, Aug. 18, 2007. http://election.kz/portal/page?_pageid=153,604812&_dad=portal&_schema=PORTAL

124 *Press release*, Democratic Party of Kazakhstan "Азат", August 24, 2007. http://eng.azat-party.info/activity/pressrelease/2007/08/24/pressrelease_2369.html

significantly between 2004 and 2007, the regional election commissions remained largely opaque.[125] Greater transparency, at all levels, would significantly improve public confidence.

Assessment

One contribution of the Sailau system is noteworthy; the use of an electronic voting terminal that needs no special preparation for election. This is possible because all election-specific information is carried to the Sailau voting terminal on the ballot card carried into the voting booth by the voter. This significantly reduces the complexity of pre-election set-up and testing for the voting terminals, and it means that the voting terminal firmware is considerably simpler than the firmware of cosmetically similar touch-screen electronic voting systems used elsewhere in the world.

The principal advantage of the Kazakh Sailau system is that it centralizes control. Election observer reports from all three elections where this system was used noted numerous problems at the polling-place level. Joseph Harris noted in 1934 that use of voting machines removes the opportunity for many of the traditional types of election fraud.[126] This clearly applies to ballot box stuffing and miscounting of votes. In the case of the Sailau system, because of the use of an electronic pollbook, the system also allows rapid detection of multiple voting as soon as the election results uploaded. In 2007, for example, OSCE observers were able to identify 585 voter ID numbers that had been used to obtain 1,324 ballots shortly after the polls closed.[127]

One feature of the Sailau system leaves open the possibility of retail vote fraud, that is, fraud involving buying individual votes or coercion of individual voters: the 4 -digit control numbers that the system issues to voters to permit voter verification. These numbers can be used to prove, to those who buy votes, that the voters have voted as instructed. To do this, the voters must give the buyer their number before the polls close. At the close of the polls, the buyer can then inspect the printout of verification numbers to verify that the voters voted as instructed. This constitutes a potential violation of voters' rights to a secretballot.[128]

125 Jeremy Franklin, *Kazakhstan Parliamentary Elections August 2007,* Norwegian Centre for Human Rights, NORDEM Report 6/2007, pages 21-22. http://www.humanrights.uio.no/forskning/publikasjoner/nordem-rapport/2007/0607.pdf

126 Joseph P. Harris, *Election Administration in the United States.* Page 60

127 *Republic of Kazakhstan Parliamentary Elections 18 August 2007,* OSCE/ODIHR, page 25.

128 *Republic of Kazakhstan Presidential Election 4 December 2005,* OSCE/ODIHR, page 4

Centralized control is an advantage when there is evidence of widespread fraud at polling places, but it poses risks when central authorities may not be trustworthy. The following features of the Sailau system are cause for concern in this regard.

The Sailau system only releases a 4-digit control number to the voter on request, and it records the fact that the voter requested a control number on the electronic ballot. If the central authorities were dishonest, they could program the system to cheat only when voters do not request a control number, while remaining honest for those voters who opt to verify their ballots.

The 4-digit control numbers are supposed to be random, but without the ability to verify the actual software used to issue control numbers, there is no way to confirm this. If the randomization is not done correctly, it would be possible for voters, knowing their own control number, to infer the control numbers of other voters. While we do not know anything about how the Sailau system generates its random 4-digit codes, this problem has been observed in the Hart InterCivic voting system, which uses similar random 4-digit codes for different purpose.[129]

The use of the same computer system to perform both electronic pollbook functions and electronic ballot initialization allows the possibility that voter identity could be covertly encoded on the voter's electronic ballot.[130] This would allow a dishonest government to harass those citizens who did not vote correctly. In the case of the Sailau system, this problem is somewhat mitigated by the fact that, when multiple voters arrive in quick succession, it may be difficult to track which voter gets what ballot card. When there is no line of waiting voters, however, tracking is straightforward. It is noteworthy that this particular approach to election fraud is also a possibility in many other voting systems where the electronic pollbook function is integrated with the voting system.

The lack of full disclosure of the data formats used on the CryptoKey makes it impossible to know whether the electronic ballot box function of the Sailau system records the order in which votes were cast. Given that it is easy to observe the order of voters as they deposit their electronic ballots in the electronic ballot box, any sequential record of the votes is a potential violation of the voter's right to a secret ballot.

The legislation giving the electronic record priority over all paper records adds a layer of difficulty. If the record stored on the CryptoKey is actually the record

129 Srinivas Inguva, Eric Rescorla, Hovav Shacham, Dan S. Wallach, *Source Code Review of the Hart InterCivic Voting System*, July 20, 2007, page 46. http://www.sos.ca.gov/elections/voting_systems/ttbr/Hart-source-public.pdf

130 *Republic of Kazakhstan Parliamentary Elections 18 August 2007,* OSCE/ODIHR, page 12

approved by the election committee, and if the CryptoKey is actually secure, then giving priority to the electronic record is reasonable. Unfortunately, no amount of testing or demonstration can prove that there is not a way to corrupt the election results. Furthermore, there is evidence that changes were made to the CryptoKey or its drivers between manufacture and delivery to the Central Election Commission.[131] If there is any way that the data on the CryptoKey can be altered or falsified, the automatic legal priority given to this data allows all other evidence of what might have happened to be disregarded.

The secret legal requirement to which the Sailau system was certified may be benign, but since it has never been revealed, we cannot be sure of this. An untrustworthy government could secretly require that all cryptographic systems include provisions for the government to defeat the cryptography. The United States government attempted to openly legislate such a requirement in 1994.[132] Putting such a requirement in place, whether in the U.S. or in Kazakhstan, would allow state security services to make arbitrary changes in the voting system without anyone knowing.

The e-government web site of the Kazakh Central Election Commission is very well designed, but it does not provide access to either official or unofficial election results at the polling place level. Kazakh law requires paper copies of the polling place results be posted at the polling place. If voters could compare these results with the official results from the Central Election Commission, they could check that the national results correctly incorporated the results from their polling places. Unfortunately, as configured in the past three Kazakh elections, the aggregation of polling-place election results has not been conducted transparently.

In summary, the lack of transparency makes it impossible to determine if the Sailau electronic voting system is better or worse than the established paper system in Kazakhstan. The system transfers power away from the local election officials with known problems, but this transfer is not total. The weaknesses surrounding the 4-digit control numbers still permit classical forms of retail election fraud. Furthermore, the transfer of power to the central authorities poses risks because the Sailau system contains numerous elements that could allow a dishonest central government to falsify election results in a manner that would be very difficult to observe. Even if the current government is trustworthy, that is no guarantee that future governments will remain so.

131 *Republic of Kazakhstan Parliamentary Elections 18 August 2007,* OSCE/ODIHR, page 13

132 *White House Press Release,* Washington DC, February 4, 1994. http://epic.org/crypto/clipper/white_house_statement_2_94.html

Several defects of the Sailau system have been ignored in the above discussion. The touch-screen display used on the voting terminal was only large enough to display three options. With five candidates in the 2005 presidential election and seven parties in the 2007 parliamentary election, voters were forced to scroll up and down through the ballot to make their selections. While replacing the voting terminals might be expensive, there are no technical barriers to doing so.

The Sailau system, as used in 2005 and 2007, offers no way to conduct a recount, should there be any question about the integrity of the data from some polling place. In theory, if the smart cards used as electronic ballot carriers were single-use cards, a recount of the data from the electronic ballots would be possible. The Belgian system, using magnetic stripe cards, allows such a recount. Unfortunately, neither the Belgian nor Sailau cards are read-only; reading the ballot selections from a smart card or a magnetic stripe card requires specialized software. If there is already doubt about the correctness of the data from some polling place, it is hard to see how a recount conducted using specialized software on read-write media could alleviate this doubt. Only by moving all the way to the frog architecture could such doubts be addressed. This would require complete public disclosure of all details of the smart card, the data representations used on it, and the mechanism by which the card becomes read-only after the vote is cast.

Ireland: A Decade of Electronic Voting

Ronan McDermott

Background

In April 2009, almost a decade after the process began, Ireland's Minister for Environment, Heritage and Local Government,[133] announced that because of the huge additional costs to upgrade hardware and software and the risk that even this investment might not fully guarantee the reliability and accuracy of the resulting system, the electronic voting solution procured in 2003 would be abandoned. In the future, elections held in the Republic of Ireland will use paper ballots counted manually.

Summary of the Irish Electronic Voting Experience

On 29 April 2004, the interim report of the Commission on Electronic Voting (CEV), established just eight weeks earlier, sent shockwaves round the corridors of the Irish parliament (Dáil). Contrary to expectations, the CEV had,

133 The Irish government department (ministry) with responsibility for elections management

in somewhat, contorted language[134] failed to endorse the use of procured electronic voting machines for the European Parliament elections, scheduled just weeks ahead in June 2004. What had, just months earlier, appeared a fait accompli for the new technology in its first nationwide rollout, had become an embarrassment.

The Government of the day had no choice but to revert to paper ballots for the 2004 polls. Meantime, the CEV continued its work, releasing a comprehensive report in December of that year. In May 2006, the general (parliamentary) elections were, again, held using paper ballots. In July 2006, almost 27 months after its initial findings, the CEV's second and more comprehensive report, gave a qualified recommendation on the actual voting machines, but rejected the back-end election management systems used to prepare for and count the results of elections.

The machines have not been used since and sit gathering both dust and political toxicity. On 23 March 2009, the current Minister said it was "inconceivable" that the procured electronic voting machines will ever be used. He cited three "major problems" standing in the path of their use:

- Enormous cost of the required modifications to the systems: a further 28 million Euros ($38.5 million USD)
- Continuing controversies over electronic voting in Holland and Germany
- Lack of public confidence in electronic voting

In May 2009, the Minister announced the system would be scrapped, citing the reasons outlined earlier. The likelihood is that a very, very long time will pass before such a project is again initiated in Ireland.

134 "On the basis of its review of expert reports, submissions received and other relevant information to date, the Commission finds 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." http://www.cev.ie/htm/report/executive.htm

Schedule of Key Events[135]

- *November 1998* – Department of the Environment, Heritage and Local Government, invited companies with products which would facilitate electronic voting and counting in PR/STV electoral systems to furnish details of those products

- *May 1999* – the 1999 Local Elections Disclosure of Donations and Expenditure Act included a provision that ballot papers from the 1999 local elections could be used for research into the use of electronic methods of vote recording and counting

- *February 2000* – the government approved, in principle, the introduction of direct vote recording and the drafting of enabling legislation, with a view to introducing electronic voting and vote counting at the 2004 European and Local Elections

- *June 2000* – tender notice issued for procurement of suitable hardware and software system

- *December 2000* – the government noted the proposal to begin testing the chosen system proposed by Nedap/Powervote

- *August 2001* – six voting machines were purchased for testing purposes

- *November 2001* – the 2001 Electoral (Amendment) Act provided the statutory authority for the introduction of electronic voting and vote counting at a Dáil Election

- *November 2001* – 600 voting machines were ordered for use in three constituencies in the 2002 General Election

- *April 2002* – statutory instruments approving the use of electronic voting in a Dáil Election in three constituencies (Dublin North, Dublin West, and Meath) were signed

- *June 2002* – a further 400 voting machines were ordered for use in four more constituencies in the Second Nice Treaty Referendum in October 2002

135 Events up to 29th April 2004 are directly quoted from the report of the Comptroller and Auditor General of Ireland available http://www.audgen.gov.ie/viewdoc.asp?fn=/documents/annualreports/2003/Chapter8.pdf

- *March 2003* – 6,000 more voting machines were ordered for use countrywide in Local and European Elections in 2004
- *1 March 2004* – Commission on Electronic Voting established to report on the secrecy and accuracy of the chosen system for use in the June 2004 elections
- *29 April 2004* – interim report of Commission could not recommend proceeding with the introduction of electronic voting for the June 2004 elections
- *July 2006* – second report of the CEV recommends that the hardware may be used, with modifications, but that the election management software cannot
- *2007* – no attempt is made to use the electronic voting machines for the 2007 General Elections
- *23 April 2009* – minister announces that the system would be scrapped citing likely €28m cost of upgrades and lack of public confidence in the system

Elections & Elections Management in Ireland

Irish citizens of voting age directly elect the country's president, members of *Dáil Éireann* (the lower house of the *Oireachtas* or parliament), local government bodies and Irish members of the European Parliament. Dail elections are held using the single transferrable vote[136] version of proportional representation. Provision is made for British citizens residing in Ireland to vote in parliamentary elections. EU nationals residing in Ireland may vote in European Parliament elections. All residents in Ireland of voting age may participate in local government elections.

There is no national electoral management body in Ireland. The minister for the Environment, Heritage and Local Government is the Government Minister responsible for electoral and referendum legislation. Elections/referendums are conducted by independent returning officers in accordance with legislation. Voter registration is managed by local authorities.[137]

In keeping with the general trend in Europe, Ireland is moving towards independent management of elections. Certainly, this process has been

136 See http://aceproject.org/regions-en/other/IE/case-studies/ireland-the-archetypal-single-transferable-vote-system-1997/?searchterm=STV

137 For more information please visit http://www.environ.ie/en/LocalGovernment/Voting/

accelerated by the failure and political divisiveness of the electronic voting issue. The program for government (a political agreement between coalition parties following the 2007 general elections) states:

"We will establish an independent Electoral Commission to take responsibility for electoral administration and oversight. This Commission will:

- *Implement modern efficient practices for the conduct of elections, becoming a standing Constituency Commission for the revision of constituency boundaries.*
- *We will, in its terms of reference, stress the importance of avoiding, where at all possible, the division of small counties or small parts of counties into separate constituencies;*
- *Take charge of the compilation of a new national rolling electoral register;*
- *Assume the functions of the Standards in Public Office Commission in relation to electoral expenditure and examine the issue of financing of the political system."*[138]

Drivers for the Introduction of Electronic Voting
Hard Factors
Cost
While "efficiencies" were a factor, cost was definitely not the most important driver of the introduction of electronic voting in Ireland. Given the complexities of counting PR-STV ballots, the primary cost-savings were anticipated at the counting phase; though the reduction in the cost of ballot papers was a factor. In retrospect, the cost of storage, increased IT support staff, and any introduction of VVAT along with major reengineering of the counting software to bring the solution into line with stakeholder requirements proved too high and still risked failure. Rather than throw good money after bad, the responsible minister cited cost as a primary factor in the decision to abandon the project in April 2009.

Speed of Count
Counting in PR-STV can be extremely expensive, particularly in large constituencies where the race is narrow and the count and any recounts can go on for a week or more. The relative complexity of the PR-STV count, with the initial mixing and subsequent distribution of surpluses, requires

138 See http://www.greenparty.ie/government/agreed_programme_for_government

larger numbers of trained experienced counting staff. Accordingly, while the introduction of electronic voting at the polling station was expected to deliver some savings over the long run, significant cost savings were anticipated in the reduction in personnel and time required to conduct counts.

Soft Factors

Transparency

Any reasonable comparison of the procured electronic voting system with the paper system it was designed to replace is likely to conclude that the overall transparency of the process would be diminished, rather than enhanced. In fact, the lack of transparency implicit in electronic voting, combined with the rather opaque process by which the chosen solution was procured and implemented, appeared to have contributed to the subsequent breakdown of the political consensus and the drain of public support for the new technology.

Sustainability

Given the broadly positive reception to the general concept and given a more careful procurement, it is fair to suggest that an affluent, literate country such as Ireland could sustain an electronic voting system. The damage to the trust in the procured system, however, suggests that no remedial measures could fully eliminate concerns. With almost 60 million euro invested to date, it will be a long time before Ireland ventures back into electronic voting. Any future attempt to introduce electronic voting to Ireland will first have to overcome the deficit in trust left by the failure of the aborted first attempt.

Cultural Relevance

The Republic of Ireland, in the latter part of the twentieth century was experiencing unprecedented growth, driven in no small measure by its "Celtic Tiger"[139] reputation as a country where the highest of the high-tech companies all did business. The Government of the day, in its vehement dismissal of any criticism of the procured solution placed heavy emphasis on the embarrassment that would result if Ireland had to return to the peann luaidh (the Gaelic for lead pencil, referring to paper voting and manual counting). The Prime Minister, at that time, warned "… this country will move into the 21st century being a laughing stock with our stupid, old pencils."[140]

139 The Economist. May 17, 1995. Page 15.

140 Dáil Éireann - Volume 625 - October 17, 2006, available at http://debates.oireachtas.ie

There's a certain tragic irony in Ireland's desire to be a twenty-first century democracy but, rather than develop a native solution using the considerable skills available to any indigenous effort, the task was outsourced to a Dutch company whose solution was a first-generation approach.

It is worth mentioning an unanticipated and particular cultural impact of the new technology. Under the PR-STV system, counts and recounts in a large constituency could go on for days and days. Candidates would have early insight into the likely battle ahead based on the "tally" of first preference votes. This prepared candidates for the possibility of defeat. Under the new arrangements, however, the results were available within tens of minutes of the start of the count. "One of the abiding images [of the 2002 pilot] was the distress of Nora Owen, a former Minister for justice, who was clearly shocked at the way she lost her seat without the normal warnings that arises during the manual count process."[141] It is fair to suggest that this culture shock to politicians played some part in the erosion of confidence in the procured system.

Civic Acceptance
Typical of projects in most countries, there was widespread public acceptance of the introduction of electronic voting in Ireland. The pilot tests were characterized by voter satisfaction and apparent success. The general atmosphere was positive. Nevertheless, the exposure, during the pilot test, of the procured systems also allowed many voters, citizens, and politicians to examine the technology in greater detail for the first time. This gave rise to the first questioning of the suitability of the procured solution. This grew into a broad coalition of the civil society, political, and technocratic communities united in opposition to the procured solution – it should be stressed that there was no principled objection to electronic voting.

Political Acceptance
There was almost unanimous political acceptance of the introduction of electronic voting to Ireland. This is evident from the early debates in Parliament and in the relevant oversight committee (the Oireachtas Committee on Environment, Heritage and Local Government). The early legislative changes required to permit the use of old ballot papers for testing and to facilitate the pilot tests in several constituencies all passed without problems. Indeed, right up to 18 December 2003 (the date of the parliamentary committee hearing at which the government party used its majority to support the use of the procured systems), there remained cross-party agreement on both the principle of electronic voting and, with reservations, the procured solution. Thereafter, opposition parties united against the procured solution led to the establishment of the Commission on Electronic Voting, a few months later.

141 See http://www.irishtimes.com/newspaper/ireland/2009/0424/1224245294067.html

Procurement process and pilot tests

The procurement of the Powervote/NEDAP solution was given a clean bill of health by the Comptroller and Auditor General.[142] Nevertheless, in hindsight, the vendor-driven approach was detrimental to the best outcome. From the very beginning, vendors were intimately involved with the process. In many circumstances, vendor-driven procurement risks being characterized by marketing hype rather than by careful and thoughtful determination of actual requirements. Only one vendor was chosen for the early, inexpensive test phase, so, in effect, vendor lock-in was assured from this point. Absent a more formal and detailed requirements gathering process, maintaining competition in the procurement until after the test phase would have helped deepen the understanding of the issues with e-voting systems in general. Having committed to a single vendor so early in the process, the government and the implementing department had no incentive to take an objective look at the genuine issues raised following the pilot tests. The comptroller's report made the following statement:

"While it is acknowledged that the decision to move to electronic voting and counting was primarily influenced by factors other than cost, the project should have been subject to more rigorous cost/benefit analysis in view of the scale of the financial commitments involved."[143]

During the limited pilot testing in 2002, accusations of suppression of reports of tests were leveled in the Irish parliament as well as by a number of stakeholders.

Political Consensus Breaks Down

In December 2003, hearings of the Oireachtas Joint Committee on Environment and Local Government took place. At first, civil-society organization Irish Citizens for Trustworthy EVoting made a presentation as did the Labour Party. Detailed question and answer sessions followed. At a subsequent hearing on 18 December, representatives of the government department, the vendor, and civil society experts were in attendance. Though a letter of intent had been signed in January 2003, the contract to procure the full 7,000 electronic voting machines required for a nationwide rollout had not been signed. Opponents of the procured system on the Committee felt the Committee had the potential to maintain bipartisan consensus on the issue.

142 See http://www.audgen.gov.ie/viewdoc.asp?fn=/documents/annualreports/2003/Chapter8.pdf

143 *Republic of Kazakhstan Presidential Election 4 December 2005*, OSCE/ODIHR Election Observation Mission Final Report, Warsaw, February 21, 2006. http://www.osce.org/item/18133.html

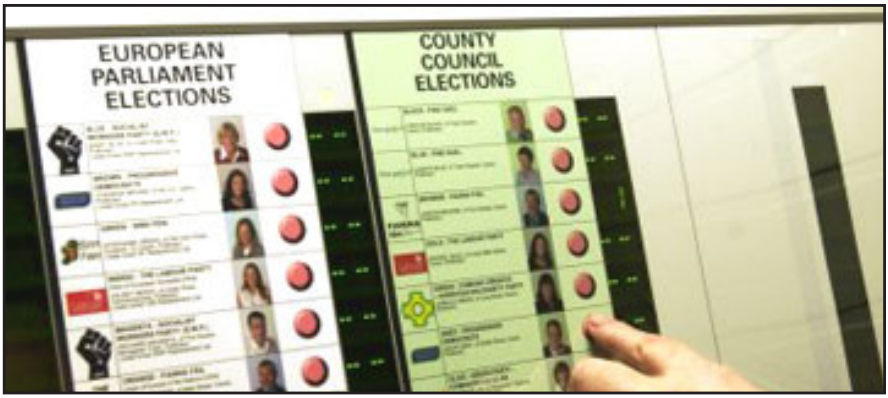

Figure 9 - An Irish e-Voting machine

On one side, an opposition committee member argued, "There are major questions still to be answered regarding the security and integrity of the electronic voting system…We cannot make a judgment until all questions are answered… [W]e have no choice but to await its response before making a decision based on all the available information."[144]And on the other, a government member countered, "I propose a different course of action.

From what I have heard over several meetings, I am satisfied with the integrity and security of the system…I propose now that we fully endorse the implementation of the electronic voting system and that we encourage the Minister and his officials to roll out their programme as early as possible."[145]

The matter went to a vote and, using its majority, the government side prevailed. The political consensus evaporated. The next day, 19 December 2003, the contract to procure the additional 7,000 machines was signed and the scene was set for nationwide use of electronic voting for the June 2004 European Elections. Political opposition hardened and a concerted campaign within the Irish lower house commenced in which the issue of electronic voting was raised at every opportunity. Coupled with increased advocacy by civil society opponents and growing negative publicity, this forced the government's hand.

The Commission on Electronic Voting (CEV)

The CEV was established on 1 March 2004. Its terms of reference were:

"(1) The Commission, which shall be independent in the performance of its functions, shall prepare a number of reports for presentation to the Ceann Comhairle (the Chairman of Dáil Éireann) on the secrecy and accuracy of the

144 Available from http://debates.oireachtas.ie/

145 Ibid

chosen electronic voting and counting system i.e. the Powervote/Nedap system.

(2) The Commission shall make one or more of such reports to the Ceann Comhairle not later than 1 May, 2004 comprising recommendations on the secrecy and accuracy including the application or non-application as the case may be of the electronic voting and counting of the Powervote/Nedap system for the local and European elections on 11 June, 2004.

(3) The Commission's subsequent report or reports will record its views of the operation and experience of electronic voting and counting at elections.

4) In carrying out its work, it will be open to the Commission to review the tests already undertaken to validate the electronic voting and counting system and to have further tests undertaken. It may also retain the service of such consultants or other persons that it considers are desirable.

(5) The Commission shall be entitled to invite and consider submissions on such basis as it thinks appropriate."[146]

The underlined text in the above ToR was added a week after the creation of the CEV and reflected the desire on the part of the Irish Government to make it explicit that the CEV would be required to give a go/no-go to the use of electronic voting nationwide in June 2004.

The interim report, cited earlier, effectively stalled any use of electronic voting until the comprehensive review of work to date, including a broad public consultation and a wide range of additional technical tests were undertaken.

It is beyond the scope of this case study to even précis the work of the CEV. But it is worth reproducing the table of contents of its first report (Annex 1) in order to demonstrate the significant effort involved and to emphasize that this all took place after Ireland had procured over 7,000 electronic voting machines.

The second report, in 2006, was similar, with additional sections on physical and operational security, on a comparative assessment of electronic and paper solutions and on the Council of Europe's ***E-Voting Best Practise***. It stated, "The Commission accordingly concludes that, when compared in terms of secrecy and accuracy, the existing paper system is moderately superior overall to the chosen electronic system as currently proposed for use in Ireland (and in some respects only marginally so)."[147] In measured language that characterized the

146 http://www.cev.ie/htm/report/terms.htm

147 http://www.cev.ie/htm/report/second_report/pdf/Part%207%20Summary%20and%20Conclusions.pdf

reporting of the CEV, this amounted to a damning indictment of a system that had cost the Irish taxpayers in excess of 50 million euro.

The point about the CEV is that it was too late. Everything the CEV did and, particularly, how they did it, including high transparency, wide and deep public and stakeholder consultations, independent and expert services procured – if done by the Department of the Environment as a prelude to the process of introducing electronic voting in Ireland – would, almost certainly, have resulted in very different outcome.

It is perhaps unfair to criticize the civil servants responsible – they had the misfortune to lack the autonomy from political interference that characterizes the best practice in elections management. The implied criticism of politicians may also be unfair but the buck has to stop somewhere.

The procured solution[148]
The following is a technical overview of the procured system taken from the second report of the CEV. Figure 10[149] showcases an illustration of the Irish e-Voting system component.

- **Voting Machine (VM) Powervote ESI2** – which is also the polling booth, has paper ballots as the user interface inserted into the voter's panel of the voting machine. This allows voters to select their preferences by pushing buttons for candidates or options, while keeping a full overview of what they have selected and still can select.

- **Ballot Module (BM)** – where the election configuration is programmed with security checks via PRU and the IES software and is placed in the VM before the election and where the votes cast are stored redundantly with security checks.

- **Programming and Reading Unit (PRU)** – connected to the PC to allow for communication between PC and Ballot Module. The PRU also verifies the correctness of the election configuration.

- **Integrated Election Software (IES)** – runs on a PC and is used to define polls for all electoral areas. IES is responsible for configuring ballot modules and providing correct information for printing ballot paper overlays to fit the voter's panel of the voting machine. At the close of polls IES reads in the vote data from each ballot module, carries out the count and tabulates the results.

148 Available at http://www.cev.ie/htm/report/second_report/pdf/Appendix%203%20Technical%20Description.pdf

149 Ibid

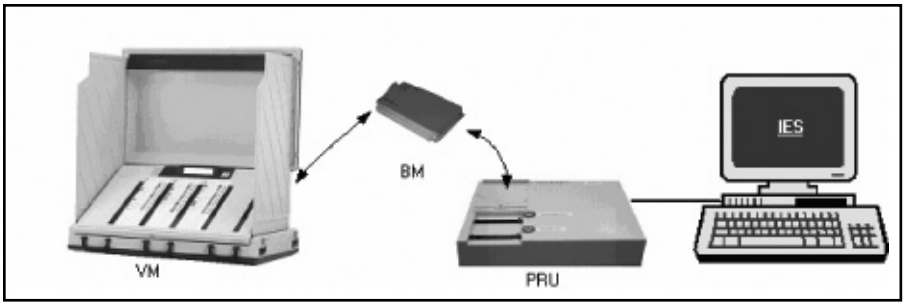

Figure 10 - An illustration of Irish e-voting system components

Considerations for EMBs

- Transparency is simply not negotiable; even bad test results can be overcome but failure to disclose does irreparable damage to trust and confidence
- Consensus means much more than the absence of dissenting voices
- Do not be dismissive of voter and stakeholder concern
- Trust is a delicate thing
- Keep vendor options open as long as possible; long term savings are worth the short term costs of evaluating multiple solutions; consider procuring test equipment from multiple vendors; avoid vendor lock-in to the greatest extent possible
- Cost benefit analyses or RoI (return on investment) calculations are complex and must take a broad view
- Plan lengthy periods of stakeholder-centric public consultations – consider the creation of a body like the Irish Commission on Electronic Voting but do so before, not after, procurement
- Any EMB (or any donor considering support to an EMB) considering the introduction of electronic voting should closely read both the 2004 and 2006 reports of the Commission on Electronic Voting; together with the other sources referenced in this case study they offer a cautionary insight into the immense challenges of making the paradigm shift from paper to electronic voting

Party and Candidate Registration

Every election involves identifying political parties and/or candidates, verifying the eligibility of these contestants, and the creation of some form of ballot. In a national election this process usually involves an easily manageable number of contestants. Local elections, which may require conducting hundreds or even thousands of unique elections simultaneously, multiply the work by a significant factor without increasing the time available to complete that work. The increased work, limited time, and large amount of data to be managed are problems that can be easily improved through automation.

Data-driven system development

Party and candidate registration systems are a great example of data-driven system development. The EMB begins with data that must be stored and analyzed; once a system is put into place to help manage the data, additional uses become apparent. The England example that follows clearly identifies this evolutionary process, when the EMB realized that data held in registration software could be used for election management.

In party and candidate registration systems, the EMB begins with information about political parties, including information such as:

- Party name and abbreviation

- Logo
- Party officers
- Contact information
- Qualification
- Date of registration

When the EMB begins to register candidates, the information might include some of the following:

- Name
- Political party
- Eligibility
- Date of registration
- Position on party list
- Contact information

Obviously, political party information that has already been collected need not be entered again for each candidate. The relationship between party and candidate is easily reflected in a relational database. Candidate eligibility criteria may include such information as:

- Citizenship, age, and whether the candidate is registered to vote within the relevant constituency (this can be confirmed through joining data from the voter register)
- Whether the candidate already holds an elected office
- Whether the candidate has exceeded any legal term limits for holding the office (can be cross referenced with data from previous elections)
- Whether the candidate is running for more than one office simultaneously (can be determined by analysis of the candidate data)

- Whether the list of candidates for any party meets any gender or other quota requirements (can be determined by self-reference to the candidate data

- Whether the candidate is a convicted felon

Some countries have a more complex relationship for parties that include coalitions or alliances, and the database may be expanded to include these entities as well.

If the system development stopped with simply managing this data it would already offer a valuable tool for EMBs, providing a way to track time of registration, a way to record whether information has been validated by an election authority, contact numbers for party officials and candidates, etc. However, the existence of the data also suggests an obvious additional application – an automated system for creation of ballot masters. An automated system for creating camera-ready ballot masters can help to reduce error by eliminating redundant data entry. Names of parties and candidates need not be re-typed for inclusion on the ballot; they can be accessed from the database.

When this data is juxtaposed over polling station and voter registration data, it becomes possible to go beyond creation of ballot masters, and also automate the process of deciding how many ballots to print and how many to allocate to each polling station. By adding data such as the size and weight of polling station kits (including ballot boxes, security screens, pens and pencils, etc.), and information about the vehicles available it is possible to automate creation of a plan for distribution of materials to the polling stations.

Some countries have also used ballot and polling station data to automate printing of counting and tabulation forms. By including information to identify the polling station, and all names of contestants, these systems help reduce the workload and possibility of error when filling out results forms.

When the polling station data has been incorporated into a management system for ballot production and pre-printing of result reporting forms, technology can help facilitate more sophisticated management of polling stations, including splitting large stations and merging small ones.
Every election has a number of important dates – deadlines for registration of parties and candidates, periods when campaigning is allowed or not allowed, cutoff time for registering objections, etc. Once the election date is known, all of these dates can be automatically calculated in an

automated system. The systems can then be used to automatically generate letters and notices to political entities using the contact information already in the database. While not usually integrated with party and candidate registration systems, many countries also have requirements for reporting of political finances, including sources of income, amounts spent on campaigning, assets, and liabilities, etc. The system can be automated to produce reports of political entities who have not submitted such reports.

"Data-driven solution provide an opportunity for incremental development, offering low-cost, low-risk tools, and allowing for a slow learning curve."

One common factor in the case studies is the system design was driven by election managers based upon their need to improve election management tools. This is in marked contrast to most election technology that is developed by external vendors with minimal electoral expertise, seeking new markets for their technologies.

Data-driven solutions provide an opportunity for incremental development, offering low-cost, low-risk tools, and allowing for a slow learning curve. Many data-driven solutions are developed in-house, and are therefore, easy to maintain with existing staff.

Case studies – the contexts

The case studies on party and candidate registration systems represent a range of countries from emerging to mature democracy, highly charged political environments, concerns of voter apathy, and wide disparities in affluence. The infrastructure of the countries represented ranges from advanced to under developed, with inadequate electricity and no nationwide communication system. The studies include systems developed for the most recent election and systems that have been developed over many election cycles.

These differences in local context might suggest wide variations in the level of technology chosen, but the task of party and candidate registration lends itself to a fairly low-tech approach. It is not uncommon to see such a system evolve from spreadsheet to simple desktop database to client-server database. This type of evolution is apparent in the two systems that have evolved through more than a single election cycle.

Common issues

One issue that is raised in the case studies is the problem of proprietary systems. If a proprietary system is used, the EMB may be locked in for many years and be required to depend upon the vendor for maintenance and modifications to the system; this maintenance may cost as much or more than the initial cost of procurement. Proprietary systems sometimes also use proprietary databases, making it difficult to extract the data for other purposes.

Another issue addressed in the case studies is the temporary nature of all systems. Reasons cited for needing to modify or abandon a system include legal changes, political pressures, changes in operating systems, and obsolete technology. In some cases these external factors led to minor changes; in other cases they required significant overhaul of the system.

The case studies all mention the relationship between systems and the law. In some cases laws must be modified to allow for the use of technology and to define the legal status of electronic documents and electronic signatures. In all cases it is important for system developers to be familiar with election laws to ensure the system is not at odds with them.

The case studies also highlight the importance of good communications with political parties, both in the decision-making process and throughout the process of managing an election.

All three case studies cite issues with technology capacity of the EMB. It is an ongoing challenge for EMBs to recruit, train, and retain qualified technology staff. This can lead to reliance on international assistance, dependence on external vendors or consultants, or inability to develop adequate systems to meet EMB needs.

Guyana: Solutions in Candidate in Party Registration, Lessons Learned and Implications for EMB Operations

Gavin Campbell

Background

General and regional elections were conducted in Guyana in August 2006. By comparison with previous elections, the run-up to the election period was generally peaceful. Elections in Guyana are overseen by a permanent Elections Commission, composed of a chairman and six commissioners. Three of the commissioners are nominated directly by the president and three on the advice of the leader of the opposition. The Elections Commission has a permanent secretariat which is responsible for the management and operations associated with elections.

Electoral System

The electoral system used in Guyana is a mixed system of list proportional representation (PR) with geographic representation. For the purposes of general elections, the country is divided into 10 geographic constituencies, which coincide with Guyana's 10 administrative regions. Each constituency is

assigned a number of seats based on the size of its population. The total number of seats assigned through this mechanism is 25. The remaining 40 seats are assigned through a national "top-up" mechanism, whereby all of the votes cast are treated as being for a single, national constituency. The seats won by a given party in the geographic constituencies are then subtracted from the results of this second exercise, so that the overall number of seats assigned to a given party reflects the votes cast nationally. There is a mechanism in place to add additional seats if a party's gains in the geographic constituencies are out of proportion with its national showing. There is an additional requirement that one third of the candidates be female for both the geographic constituency lists (taken as a whole) and for the national top-up list. In the case of regional elections, each of the 10 administrative regions is considered to be a single constituency and the same principles of list PR are applied.

General IT Capacity

Over the years, the Guyana Elections Commission (GECOM) has been able to develop a fairly high level of competence in the use of technology. In the period following the 2001 general and regional elections, the position of IT Manager changed hands on a number of occasions, each time to a person from outside the organization. This was largely due to perceived political bias on the part of whatever Guyanese the GECOM appointed to this position. This lack of continuity inhibited any major capacity development during this period. This was addressed in April 2005, when an international consultant was engaged to oversee the department during preparations for the 2006 elections.

The IT Division at the time of the 2006 elections consisted of the overseas consultant, two programming staff, a systems administrator, and two support technicians. At the time, the Elections Commission had competencies in the areas of software development with Microsoft Visual Basic.NET and Microsoft SQL Server, and was able to support the systems developed in house. There was a third-party proprietary system used for the production of national ID cards (which serve as the primary means of identifying voters at the place of poll) but this system was only used to store data temporarily for the production of ID Cards. The permanent database used for the storage of all the data relating to electoral registration was designed, developed, and supported in-house. This was a change to the previous arrangement whereby the proprietary system was responsible for capturing photographs and signatures, as well as storing both the images and demographic data for ID production. This change was motivated both by the difficulty in providing transparent stakeholder access to the data contained in a proprietary system and by a desire to have a unified data store for ease of reporting. During the period prior to the 2006 election, representatives of the governing party

and the opposition were invited to inspect the source code and the data associated with the registration system; however, neither group showed much interest in availing itself of this opportunity.

The mechanism for sharing this information was through a Technical Monitoring Panel consisting of the governing party, the opposition, and a representative of the donor community, the latest of a number of such organs formed over the years. During 2006, this committee was never formally convened, possibly reflecting an increased confidence on the part of the stakeholders in the work done by the IT Division, since previous election exercises had been characterized by detailed scrutiny of the IT function. At the time of writing, improved in-house monitoring arrangements were being put in place to more adequately represent the interests of stakeholders. Implementation was through a sub-committee of the Elections Commission, consisting of CEV members and senior managers, allowing a more direct interest in developments in the IT function than the policy-making Commission itself.

The Candidate and Party Registration Process

The process of candidate and party registration in Guyana centers around a single day of activity, known as Nomination Day. This is the day on which the parties wishing to contest the election are invited to submit their lists of candidates. By law, this must be at least 32 days before the date of the election. In practice, as soon as the final voter's roll has been prepared, the date for nomination is announced by GECOM and the date of the election is announced by the president. Given that the date of the election is already fairly well known in advance, and the presidential decree is something of a formality, this short timescale does not preclude either the elections commission or the contesting parties from making most of their preparations for nomination ahead of time.

It is mandated by law that the parties must submit their lists of candidates in writing according to a prescribed format. Given the electoral system outlined above, a party can submit up to three distinct lists on Nomination Day. These include lists of candidates for the 10 geographic constituencies, a national "top-up" list, and lists for each of the 10 regional elections to be contested. In order for a party to be eligible to contest the general election, it must contest at least six of the 10 geographic constituencies, incorporating at least half (i.e. 13) of the 25 "geographic" seats. A given candidate's name can appear on only one geographic list, but may also appear on the national top-up list for the same party.

Use of Technology in Candidate and Party Registration

The primary tasks after submission of lists are to ensure each list contains the required number of candidates, there is no duplication of names either across parties or across geographic lists, each candidate is in fact a registered voter, and the rules regarding gender representation have been met. By law, the chief elections officer can disallow a list in writing if it is found to be defective; in practice the parties are invited to address any defects immediately. For this reason, representatives of the parties work alongside GECOM staff members in carrying out these checks.

GECOM has developed a general purpose reporting application that is used to facilitate these checks. This allows use of the same application whenever there is a requirement for a formatted report about some subset of the voters' roll, such as disciplined services, overseas voters, or even lost ID cards handed in to the police. This application is capable of making the necessary checks against duplication and reporting on other rules, based on a user entering a list of national ID numbers.

Production of Ballots and Statements of Poll

Once the lists of candidates have been approved, artwork for the ballots and statements of poll can be finalized. In the case of Guyana, there are 10 different ballot papers and 20 different statements of poll (since the regional elections use the same ballot but a separate statement of poll). The artwork is prepared in house using Microsoft Visio, with actual ballot production done in Canada. This is not due to lack of local capacity, but due to a lack of trust in contracting either a local company or the Elections Commission staff to do this work. For reasons of transparency, two members of the Elections Commission – one representative of the governing party and one the combined opposition – travel to observe the process and to accompany the finished ballots back to Guyana.

Although a large number of parties express an interest in contesting elections, it is generally known in advance that most of these will not meet the requirements for contesting the general election, and a smaller number will not meet the requirements for a single regional election. Hence, most of the artwork can be done in advance, with only final revisions (which consist of removing parties that have not qualified in a particular constituency or regional council) needing to be done on the night of Nomination Dday.

By law, the parties are required to apply in writing for a symbol to be allocated by the Commission. Parties are also invited informally to submit electronic or hard-copy artwork for their symbol, though this is not required by the law. A few of the bigger parties make an electronic submission, whilst most parties provide hard copies to be scanned.

Impact Assessment

Compared to other aspects of the conduct of elections in Guyana, the candidate and party registration process is relatively uncontentious. The larger parties, who are sufficiently well- resourced to have access to the judicial system and the media which would enable them to generate public concern about the process, know what the rules are for registration and stick to them. In 2006, a couple of secondary parties were excluded from contesting specific geographic constituencies due to deficiencies in their lists. This was generally received with equanimity, with the exception of one minor party that had not qualified for any election. This party was given the opportunity to resubmit the following day, which it ended up not doing.

The timetable for this activity in Guyana is very short, due to the fixed interval between Nomination Day and Election Day, especially given the need to produce ballots overseas. In practice, only about a day and a half is available for the entire process, a timescale that is only feasible insofar as it is possible to predict so much in advance about which parties will contest which constituencies and the fact that the major parties are quite willing to co-operate with the process.

A local government election is planned to be held in Guyana before the end of 2010, which will present a number of additional complexities. Not only will the number of constituencies (and hence ballot paper designs) be greatly expanded, but provision must be made to conduct party and candidate registration at the level of each individual local government organ. There are a total of 71 local government organs to be elected, each of which will be divided between six and 30 constituencies. The total number of constituencies, and hence different ballot papers, is projected to be around 650.

All of these considerations will make it much more difficult to predict in advance which parties – or indeed individual candidates, who are permitted to take part in local government elections – will be contesting any given constituency. A more sophisticated technological solution must therefore be deployed for validating candidate and party submissions and translating these into ballots and statements of poll. It also seems inevitable that the policy of producing ballots and statements of poll in Canada must be reviewed given that the task at hand is more complex than a General Election with 10 constituencies, and the amount of time allotted by law is unchanged.

List of Considerations for the use of Technology in Candidate and Party Registration:

- Timescale for the processing of candidate registration lists in a list PR system will always be very short
- In less-developed countries, political parties are unlikely to have the resources to take advantage of any technological solution proposed to assist them in preparing their submissions
- Legislation may need review to allow for the use of technology, whether alongside or instead of paper forms
- Better use of resources, human and technological, to concentrate on fast processing of submissions once these have been received by the EMB
  If the number of constituencies to be contested is large, such as in a local government election, there may be no choice but to embrace the use of technology in order to expedite the candidate and party registration process
- Crucial to involve the parties intending to contest the election at an early stage of the process to ensure the rules and procedures for submission are understood (This helps avoid disputes over the validity of a party's submission; applies particularly if the electoral system is complex or different to what has been used in the past)

Sierra Leone: When Less is More - Solutions in Candidate and Party Registration

Magnus Ohman

Background

The countries of the world vary widely in terms of human, economic, and technological development. Unfortunately, Sierra Leone ranks at the very bottom in most of these areas. While it is "only" the sixth poorest country in the world measured by GDP per capita, it ranks 179th, or last, globally, in the Human Development Index (HDI) which also includes health and education measurements.[150] The education level is especially problematic with an adult literacy level of 37%; and only seven countries rank lower in the UNDP Education Index. The situation is not better regarding computer usage.

150 UNDP (2008) *Human Development Indices: A statistical update 2008.* Available at http://hdr.undp.org/en/mediacentre/news/title,15493,en.html Published 18 December 2008, Accessed 27 April 2008. Unfortunately, there has not been much development since HDI was first calculated for Sierra Leone in 2003.

A 2007 study claimed that 1% of Sierra Leoneans own a computer, but that figure may well be exaggerated, since the International Telecommunication Union states that only 0.2% of Sierra Leoneans are internet users.[151]

The former British colony of Sierra Leone underwent several periods of military rule before the civil war from 1991-2002. The end of the war was followed by presidential and parliamentary elections in 2002 and local government elections in 2004 (the first since the 1970s). The 2007 presidential and parliamentary elections were crucial, as they would represent the first peaceful handover from one elected leader to another since 1967. Equally, the 2008 local government elections were seen as the consolidation of the system of local governance. Nonetheless, there was also an understanding within the electoral management body that they needed to look longer term and build structures that would stay in place also for future elections, if Sierra Leone is to become a democracy based on regular, credible elections.

Sierra Leone has two institutions involved in the management of elections. The practical administration of elections is conducted by the National Electoral Commission (NEC); whereas, the activities of political parties (including party registration, campaign finance reporting, and general oversight) are the responsibility of the Political Parties Registration Commission (PPRC).[152] While the latter institution was constituted in the 1991 Sierra Leone Constitution, it was not created until late 2005.[153]

Overview of the use of technology in Sierra Leonean elections
Long before the 2007-2008 elections it was clear the IT structures within the Sierra Leonean electoral process were not sustainable. A joint IFES-

151 Concord Times (2008) *Sierra Leone: One Percent of Population Own PCs.* Available at http://allafrica.com/stories/200807230892.html. Published 23 July 2008, Accessed 28 April 2009. International Telecommunications Union (2009) *ITU World Telecommunication/ICT Indicators Database* Available at http://www.itu.int/ITU-D/icteye/Reporting/ShowReportFrame.aspx?ReportName=/WTI/InformationTechnologyPublic&RP_intYear=2007&RP_intLanguageID=1. Published Unknown. Accessed 5 June 2009. Sierra Leone thereby falls far below the African average of 5.5% quoted in the same database.

152 The role for which the PPRC came to be most known during the 2007 and 2008 election cycles; that of preventing and reducing election-related violence, was only implied in its legal mandate.

153 The NEC has a permanent staff of around 150, while the PPRC staff currently is less than ten, and never exceeded 30 even during the height of the electoral process.

NEC study into the organization of the NEC during the 2002 presidential and parliamentary elections concluded that the NEC's "IT capability is donor-dependent and had no maintenance contract in place or technical support."[154]

In its policy outline adopted in late 2004, the NEC Commissioners noted that:

"The establishment of a sustainable information technology (IT) system is also crucial to the successful conduct of future elections. The Commission currently lacks an IT system with trained and qualified personnel. Thus the Commission has had to resort to the services of international experts (provided by IFES) for the computerisation of its voters register. Worst [sic] still only a few of the technical staff have basic computer knowledge. Assistance is therefore needed in setting up an IT system and basic staff training on computers."[155]

In line with this, the "Establishment of an Information Technology (IT) System" was identified as one of the seven steps in the electoral reform process that was decided by the Commission in May 2005.[156]

Overall, the technology used in the 2007 and 2008 elections in Sierra Leone was more basic than in many other countries in sub-Saharan Africa.[157] The main part of the explanation lies in the low level of development in the country, and the adjustment of the technology used to that reality.[158] One main difficulty relates to the electricity needed to power any form of technology. The mains electricity system was very limited in the capital Freetown until December 2007 (after the elections), when a new power plant provided by the donor community was put in use. There is effectively no electricity available outside the capital for those who do not have access to generators.

154 IFES/NEC (2002) *A review of the organisational and service delivery structure of Sierra Leone's National Electoral Commission.* Dated December 2002. Page 6.

155 NEC Sierra Leone (2004) *Outline of areas for intervention to strengthen the NEC for 2007-2008 elections.* Dated 12 December 2004. Page 3.

156 NEC Sierra Leone (2005) *Resolution No 1 of 2005.* Dated 17 May 2005.

157 An interesting example of African high-tech elections could be the 2008 Parliamentary elections in Angola, where satellite fax machines, biometric voter ID cards and handheld computers at the polling stations led to a very expensive, though also criticised, election process.

158 Email communication with the Executive Secretary of the National Electoral Commission, Mr Aiah Mattia, May 15, 2009. Mattia also stressed that the UN electoral assistance team adviced against the use of advanced technology for reasons of "cost, sustainability and time."

As a result, the entire electoral process was effectively paper based until the information reached the NEC headquarters in Freetown, where voter registration, candidate nomination, and election results were captured digitally. Voter ID cards were produced at the registration centers throughout the country, but the use of analogue Polaroid photography and cold laminating meant that this did not require any advanced technology, let alone access to an electricity supply. The most advanced technology at the polling stations was battery-powered lamps used to illuminate the counting process, which took place after nightfall.

Technology used in the registration of political parties

Political parties register only once in Sierra Leone, as they do not need to renew their registration after a certain time, nor to register specifically to participate in elections. A long list of information needs to be provided for registration, including information on its party offices in each of the fourteen districts. However, until the 2007 elections, this information was not stored anywhere apart from on the original forms.

It is worth noting that most existing political parties registered after the end of the Civil War in 2002, when the PPRC had not yet been created, and party registration was therefore conducted by the NEC. Not all registration applications were found when the PPRC took over the files in 2006, and as a result, no one really knows how many registered political parties exist in Sierra Leone.[159]

The political parties considered to be in existence in the run-up to the 2007 elections were asked to submit updated information about the party, in accordance with the Political Parties Act.[160] The parties were provided with a Microsoft Excel database, but all chose to submit the information in handwritten form. The information was subsequently entered into the Excel database by PPRC staff and this database was shared with the NEC and other stakeholders before the elections. The same method was used for the only political party that was registered during 2007 (the Convention's Peoples Party).[161] The database included 486 data points for each party, and the six political parties (apart from

159 The registration of a political party only ceases if the party is deregistered by the Supreme Court upon application by the PPRC. The Political Parties Act Article 27.

160 The Political Parties Act (Article 24(1), states that political parties shall notify the PPRC if it intends to alter its regulations or office holders. Since no party had done this since the Commission was created, it was felt that the information available to the PPRC needed to be updated.

161 The People's Movement for Democratic Change (PMDC), which gained ten seats in the Parliamentary elections, registered through a paper only system in 2006.

the CPP) that participated in the elections provided on average 98.3% of the requested information.[162]

Overall, political parties in Sierra Leone, including the two major parties, rely mainly on less advanced technology such as mobile phones and even letters rather than email, which is not yet an effective means of communications.[163] Increasing the level of technology used in activities relating to political parties will therefore need to take into consideration the level of capacity within the political parties themselves.

Technology used in the candidate nomination process

The candidate nomination process was timed to give political parties sufficient time to select their candidates, but – crucially – also early enough to allow for ballot production (which took place outside the country). While presidential candidates were all nominated at the NEC headquarters in Freetown, both parliamentary and local government candidates were nominated at the district level (Sierra Leone has 14 districts). Validation that potential candidates were registered voters was done by checking their voter ID card registration number against a soft-copy of the Final Voters Register. This process showed if the potential candidate was registered in the electoral area in question (this was not a requirement in the parliamentary elections).

For candidates in all elections, the following information was captured on the nomination forms, which were submitted in paper form to the NEC:

- Name of candidate
- Address
- Voter ID number
- Occupation
- Equivalent information on nominators

162 Data from the PPRC database on political parties. Unpublished.

163 Based on the author's impression from having interacted with stakeholders in Sierra Leone since 2004. Both the governing APC and the previously governing SLPP have websites, but these are run by their respective UK branches.

- Statutory declaration (not for parliamentary candidates)[164]

All candidates also had to sign the code of campaign ethics developed by the NEC. For local government candidates, gender was also captured.[165]

The objection process ran simultaneously with the submission of nominations, but ended a day later to allow for objections against all candidates. Objections were heard and decided by the district electoral officer, while aggrieved candidates could appeal the decision on an objection to the NEC Commissioners.[166]

The forms, including filed objections, were sent by vehicle to NEC headquarters at the end of the objection period, where data was captured for the development of ballots, including scanning the candidate photographs for the ballot papers (these photos were taken by the NEC during the nomination process for the 2007 elections whereas candidates were required to submit their own photos for the 2008 elections).

There are no indications that the political parties advocated a different approach to technology in the elections than did the NEC, and certainly not in relation to the party registration and candidate nomination processes.[167] Overall, the candidate nomination process was hailed as

164 Political parties also had to report on the campaign finance transactions of the party as well as of its candidates. This reporting system was implemented by the PPRC rather than the NEC, in accordance with the Political Parties Act. Hardcopies (and on request soft copies) of guides and all forms were supplied to the political parties. Reports were received in hardcopy form, and data was entered into Word and Excel by PPRC with the assistance of IFES. Submitted forms were also scanned, and both summaries and the forms themselves were published on the PPRC website (www.pprcsl.info).

A more advanced reporting system would have increased the ability of the PPRC to receive, review and publish information from the political parties. However, the political parties do not have the capacity to comply with even the most basic computer based systems (few regularly use email, including most PPRC staff).

165 Presidential and Parliamentary candidates have to be able to read and speak English. This was captured through a line in the nomination form (Parliamentary) or a Statutory Declaration (Presidential), where the candidate had to declare her/himself eligible. The NEC did subsequently not investigate the language skills of the potential candidates, but waited to for any challenges against the nominations on these grounds (none came).

166 Political Parties Act 2002, Article 46.

167 Impression gained from author's participation in bi-weekly meetings between the NEC and political party representatives (through the Political Parties Liaison Committee, PPLC), as well as PPLC meeting minutes.

successful both by the candidates and by domestic and international observers.[168]

Advantages and disadvantages of the technology solutions chosen in Sierra Leone

It should not be denied that the use of more advanced technology would have brought some advantages for the process of registering political parties and candidates. For example, faster communication would have assisted the nomination appeals process. All objections were heard in various districts, but if an aggrieved candidate appealed the decision, the appeal would be heard in the capital. In several cases, the documentation and information regarding processed objections had not yet been submitted to HQ, and on more than one occasion the Commissioners dealing with appeals had to contact district staff by phone for clarifications.[169]

A related issue emerges from the fact that political parties do not nominate candidates directly in Sierra Leone, due to an oddity in the electoral law. Instead, they have been asked to provide the NEC with lists of "endorsed" candidates, who are technically nominated by individuals (in line with the constitutional right of political parties to present candidates in elections; the name and symbol of the political party appears on ballot paper for respective candidates). During the registration process in 2007 and 2008, the political parties did not adhere to the deadline for the submission of these lists, and many parties even made changes while the nomination process was ongoing. These changes were submitted to NEC headquarters. An operational electronic communication system between NEC HQ and district offices would have helped to reduce the problem of keeping the lists available in the districts up to date.

In general, the selected technology did not significantly affect the clarity or application of the candidate nomination process. The NEC chose not to conduct in-depth investigations on the eligibility of candidates, preferring to rely on statutory declarations by candidates

168 See for example European Union Election Observation Mission Sierra Leone (2007) *Final Report, Presidential and Parliamentary Elections, 11 August 2007 and Second Round Presidential Election, 8 September 2007. National Election Watch (2007). 2007 Presidential and Parliamentary Elections, Report on the Electoral Process.*

169 Author's notes from the appeals process at the NEC headquarters, 9 July 2007. This should not be an issue in future elections. The GSM networks are constantly being extended, and will certainly cover all district capitals by the time of the next elections in 2012. Through the use of GSM modems, the NEC district staff will then be able to scan and email all files within hours.

that they fulfilled the nomination criteria and official complaints to the contrary. However, this decision was not related to the technology of the candidate nomination process, rather, it was related to the lack of existing registers to cross-reference the nomination documents against (proving that candidates did not serve as public servants, etc.).

Given the low level of IT capacity in Sierra Leone, methods that may have increased the transparency of the process (such as announcing nominated candidates in real time using Twitter or similar technologies), would most likely have had a negligible impact (though the NEC website was widely used by the Sierra Leonean media for downloading election results).

It is difficult to see how the use of more advanced technology could have improved the process of registering political parties. If groups wishing to register as political parties had been required to submit their registration electronically, this could hinder the registration process due to the above mentioned low level of IT capacity of Sierra Leone in general.

Overall, a strong argument can be made that the technology solutions chosen in Sierra Leone are suitable for the country, given its level of technological, human and economic development. As mentioned, the main issue regarding use of computer technology outside of the capital is that no power grid exists and there are very few people with computer expertise due to the training and experience the receive while working at the NEC.

Admittedly, concerns remain regarding the sustainability of IT capacity at the NEC. International assistance in the field of IT did not include a significant capacity development component, mostly due to lack of time. Funding was not an issue as the cost of the elections fell short of the available funds, to the tune of several million dollars. The overall problem of maintaining IT capacity at the NEC will not be solved as long as key NEC IT staff are lost to other employers.

It is worth discussing whether more advanced technology could have decreased the time needed for reconciliation and announcement of final results, a process which was quite lengthy and did lead to some concerns.[170] In general, it is possible that the use of more advanced technology might have increased voter confidence (biometric information on voter ID cards etc). However, the actual effect of such reforms would most likely have been negligible. The costs would have been significantly

170 Part of the reason for the delay in announcing results seems to have resulted from the transparency that the NEC showed to the political parties during the conciliation process. This may be difficult to resolve through technology.

higher and the risk for mistakes, which in turn could serve to reduce voter confidence, should not be excluded. It should also be mentioned that public confidence in the NEC and the electoral processes as a whole was significantly higher than what can be considered the norm in West Africa in recent years.

The investigation that NEC and IFES did into the 2nd round presidential elections indicate that it is unlikely that more advanced technology would have significantly reduced the problem of ballot box stuffing that was discovered in that election due to turnout being reported as above 100% in 7% of polling stations.[171]

The future of election technology in Sierra Leone

No decisions have been taken by the Sierra Leone NEC indicating significant changes in technology to be used in future elections.[172] The general approach seems to be that there is little reason to fix what is not broken.

Some technological reforms will, however, need to be introduced due to changes in the technologies available. Sierra Leone will, for example, have to start using digital cameras to capture photos of voters and candidates for the next elections, as film is no longer produced for the Polaroid cameras the NEC uses.[173] Discussions are ongoing about integrating the voter ID cards with the national ID card system (currently largely defunct), though it is unlikely that this will be possible before the 2012 general elections.[174]

IT training of NEC staff continued during 2009, in the country and abroad.[175] While the NEC acknowledges that it now has a "significant set of IT equipment," it maintains that:

171 NEC/IFES (2008) *Further Study into the 2007 Presidential Run-Off Elections.* Submitted 29 February 2008. Unpublished.

172 Email communication with the Executive Secretary of the National Electoral Commission, Mr Aiah Mattia, 15 May 2009.

173 This technology is also used by Ghana and several other countries on the subcontinent. An attempt is being made by enthusiast to restart production of film for this type of cameras, but the name given to the project illustrates the challenges they are facing in an era of digitalisation. See further at www.the-impossible-project.com.

174 NEC/NRS (2009).

175 NEC (2008a) *Budget – NEC 2009 Project Extension*. Submitted 5 December 2008. Unpublished.

"NEC with its nation-wide operations is in dire need for a wide area information network for effective data management and efficient information flow. Connectivity between the Commission Secretariat and its regional hubs is non-existent making the whole operations inefficient and cost ineffective. Development of management information system with real time connectivity between the secretariat and its strategic regional hubs is being proposed to be part of the next electoral project."[176]

An overall plan for the development of a sustainable IT structure within the Commission still needs to be created. It is hoped that this process can start with the assistance of an IT consultant, included in the 2008 budget, providing in-depth knowledge of available technological solutions within the Sierra Leonean context.

Given this institution's limited funding and staffing structure, the PPRC has taken another approach. The PPRC is undergoing a restructuring process that will lead to the Commission returning all staff to the civil service and hire its own staff (the NEC underwent a similar process in 2005). As part of this process, the PPRC Restructuring Committee decided that while the Commission's communication officer will manage the website, the Commission will outsource its more advanced IT needs to a Sierra Leonean IT company or capable individual.[177]

Lessons to be learned from the Sierra Leone experience

Sustainability should always be a key factor when deciding the technology used in elections. Attention should be paid not only to the election at hand but also to following electoral cycles. We must resist the temptation to judge every election as being so crucial for democratic development of the country in question that sustainability is disregarded (this happens far too often). The goal should be the creation of an electoral process where the only point of uncertainty in the mind of the electorate is what political force will emerge victorious, not whether the elections themselves will be credible. This cannot be achieved in the long run if elections continue to depend indefinitely on international assistance.

This case study should not be seen as an argument against using advanced technology in elections. The use of technology can significantly aid a smooth electoral process, as very few elections are now run without at least some

176 NEC (2008b) *2009 Electoral Support Project Wave 3 Concept Note.* Submitted 5 December 2008. Unpublished. Also Email communication with the Executive Secretary of the National Electoral Commission, Mr Aiah Mattia, 15 May 2009.

177 PPRC (2008) *Minutes of [Restructuring] Committee Meeting held on Friday 14/11/08 at the Conference Hall. Unpublished.*

computer assistance. An approach focused on sustainability involves selecting context-suitable technology that is future proof. The latter can be very difficult given the rapid development of technological solutions. The expertise available through international technical assistance should also be centered on identifying solutions that can remain in place for some time.

It is equally important that the technology solutions chosen can be adopted and controlled by the national EMB. Even if significant donor funding is available, costly technological systems that are deemed unlikely to last and to be ineffectively utilized by the EMB should be avoided unless they are absolutely necessary for the integrity of the electoral process. As a rule of thumb, technological solutions that cannot be adopted by the EMB within a full electoral cycle (from one national election to the next) should be avoided.[178]

It is crucial that the particular characteristics of each country be taken into account. For example, the low-tech solutions in Sierra Leone are partly suitable due to the limited size of the country. Even in local government elections there were less than 1,300 candidates.[179] Naturally, more populous countries such as Nigeria and Pakistan need to take into account the time it takes to get things done given different technologies. Furthermore, countries with a higher degree of development of human, financial, and technological resources may also wish to make use of more advanced technology. Advanced technology is sometimes used to increase confidence in electoral processes which are mistrusted by stakeholders; the effectiveness of this approach is far from universally accepted. It may also be necessary to place less focus on the sustainability of the process in the rare case when a particular election is exceptionally important for democratic development (such as one immediately following armed conflict).

To conclude, it is demonstrated that the 2007 and 2008 elections in Sierra Leone show that a small country running elections that are not immediately post-conflict can run an effective and credible (and arguably more sustainable) electoral process without the use of advanced technology.

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178 This is not to imply that the EMB would not require any external technical assistance at all, but rather that it should be able to maintain overall control of the technology in question.

179 *Number of nominated candidates (final list) and ballots produced*

Election	Candidates	Ballots
Presidential (2007)	7	1
Parliamentary (2007)	566	112
District Council Chairperson (2008)	60	19
District Councillor (2008)	1,264	394

England: Applying Solutions in the Electoral Process

Robert Jordan

Background

The election management system used in England has grown slowly from the early voter registration data management system first developed in the 1970s. As the law evolved to give an electoral commission responsibility for regulating political parties, the system evolved with the law. The system was later expanded by individual electoral registration officers to allow tracking of requirements for candidates. As technology became more powerful and more affordable, additional systems were developed to provide additional capabilities, including continuous registration, support for postal voting, planning for ballot production, management of polling districts, ballot accounting, etc.

Because of the complexity and broad functionality of current election management software, it is difficult to know where to put this case

study; however, it is an important example of how systems grow and mature. We have included it, here, since this was one of the early functions of the software.

Description of Electoral Administration

The English electoral registration process is property-based. No individual can be registered without being associated to a property, although in certain circumstances this might be a loose connection, such as a park bench near a particular property. Each property is contained within a polling district. This is defined as a geographic area which is linked to an electoral area which is linked to a polling station. Polling districts are wholly contained within electoral areas at all levels.

There are a number of levels of electoral areas. The largest is the European region. In England, there are nine regions. Below that are 529 parliamentary constituencies. Some parts of the country have county electoral divisions. Below these are generically termed municipality wards and in some parts of the country there are parishes and wards of parishes. In some places, there might be up to five levels in an electoral area.

The electoral registration process has some complexities insofar as voters may have different franchises. For example, citizens of other European Union states may vote in local elections but have the option to vote in European parliamentary elections. British citizens residing abroad may only vote in parliamentary and European elections and some may only vote in European elections. These different franchises are designated by various flags within the software.

The regulations governing the electoral registration process, while complex, do not provide electoral registration officers with significant discretion as to the functionality of electoral registration software. The first software designed specifically for electoral registration was developed in the 1970s in MS DOS. This was a considerable improvement; once set up with standard queries and reports, it needed very little maintenance. Staff and printing costs were reduced. (See Annex 2).

During the 1990s, significant changes to legislation took place. Rolling or continuous registration was introduced and there was a significant increase in postal voting, coupled with changes in the way postal votes were dealt with. Technological advances were also being made and Windows-based software was introduced.

The new legal framework made provisions for an electoral commission. This body was primarily set up to regulate political parties and their finance. There are some 330 political parties registered. Each political party may register up to 12 descriptions and three party emblems or logos. The electoral commission may make recommendations for changes to the law, however only parliament can introduce changes. The electoral commission has only an advisory role in respect of electoral registration officers and returning officers.

Electoral registration officers are officers employed by local councils, usually at the municipal level, acting independently of the local council. Returning officers are often the same person as the electoral registration officer and again act independently.

Development of software for electoral administration
During the 1990s it was realized that much of the data held in electoral registration software could be utilized for election management. Initially MS DOS systems were developed. While the electoral registration software remained the core data, election management software was developed as an add-on module. Although these modules were successful to a certain extent, there were some drawbacks. Whereas electoral registration and necessary reports such as the printing of registers was very standardized, election management allowed returning officers more discretion in the way they conducted elections. For example, some returning officers may arrange a centralized count center for multiple elections whereas others may devolve this activity to many count centers.

It is not clear now as to what was the primary motivation to introduce election management software. There were obvious connections between different elements of data. A requirement for candidates on nomination, to be supported by voters from within the particular electoral area in which they were standing meant that a database linking candidates with the voter through the electoral area was an advantage; at lower election levels there might be several hundred supporters to be checked. As some data was already held in polling stations it was a natural progression to collect more information within an election management module on staffing and logistics, including equipment and materials such as ballot papers and finance. One of the most significant legal developments contributing to the need for election management software was the increase in the availability of postal voting.

The first rendition of election management software, developed in the early 1990s, was MS DOS based. This had been adequate for electoral

registration software where there were few variations in the report output, which could be easily standardized. Election management software on the other hand, demanded a much more diverse output in terms of reports, letters, and notices, etc. Returning officers needed to customize output to a much greater extent than that for electoral registration and this was difficult with an MS DOS based system. Without adequate training it was difficult to customize letters and even more difficult to customize forms. This resulted in many returning officers outputting data from the systems into other applications such as Excel spreadsheets to mail merge into customized MS Word letters, etc.

As Windows-based software emerged from the late 1990s it was possible to include generic queries which allowed returning officers to prepare customized output much more easily.

Functionality of Election management software

The key element in electoral management software is the date of the election. Once established, this allows all other statutory dates and other administrative dates to be calculated. In England statutory dates for undertaking certain activities are calculated by excluding "dies non" (weekends and national holidays), other statutory dates include these days. The software is set up to calculate dates +/- days from Election Day and whether the date includes or excludes "dies non." These dates can then be used, for example, to issue time and place notices to candidates and their agents for activities such as the counting of votes. It also provides the returning officer with a project timeline to assist with managing resources. Using the date of election as the key element allows returning officers to conduct multiple elections of different types on different dates, independently of each other.

Having set up an election, the returning officer can publish customized notices announcing an election and calling for candidates and other documentation.

One of the qualifications for a candidate to be nominated is that he/she is registered as an elector in the electoral area for which they are standing. It is a requirement that the candidate's supporters are registered electors in the electoral area. Inputting candidate details into election management software linked to registration software will instantly show whether the candidate's nomination is valid. It will also show whether the same person has supported more candidates than there are vacancies.

If a candidate is standing for a political party, that political party must be registered nationally with the Electoral Commission. The candidate may only use the name of the political party or one of up to 12 descriptions for that party. The candidate may also only use one of up to three party emblems. These descriptions and emblems are held on the Electoral Commission website. There is no automatic updating of this data. Returning officers may download the data into their own election management software for checking candidate nominations.

The polling districts, if they contain a large number of voters, may be split into more convenient sizes to be allocated to several polling stations within a polling district. Conversely, where there are a small number of voters in a polling district it may be combined with other polling districts in a polling station. Election management software allows for these procedures.

Election management software allows the returning officer to take this factor, combined with the various franchises of voters and the need to differentiate between voters voting by post and at polling stations to calculate accurately the number of ballot papers required at each polling station. Output from election management software produces camera ready artwork including emblems for the ballot papers. Ballot papers are numbered; therefore, not only are required quantities calculated, numbered ballot papers for each polling station are also calculated.

Ballot paper accounts are produced as well. This is a form used in the polling station to record exactly how many ballot papers are allocated, used, and spoiled. This data is then used in the verification process at the count of votes.

Election management software provides a relationship between the polling district in electoral registration software and the polling stations. This has been enhanced by providing a relationship with staffing and other election related functions.

Staffing details are held in a table of unallocated staff who are then assigned to a particular polling station at a particular election. One person cannot be assigned to two different polling stations at the same election. Personal details of staff are therefore kept on a permanent basis and used as required for elections. The software also provides a relationship to count centers and similar data on staffing is held in relation to count assistants, etc.

The polling station table includes details of the agents responsible for booking, key-holding, and payment as well as the equipment required, such as polling booths, etc. This data is used for calculating equipment requirements as well as booking accommodation, payment, and financial accounting. Similar data is held on count centers.

With regard to staffing, not only does election management software allow for polling and count center staff details but also any other election related function. This data is eventually used to produce summaries of expenditure.

The election management software is used to control verification of ballot boxes, to ensure all boxes are accounted for, and all ballot papers are accounted for. It is used to a limited extent in the results process insofar as hard copy declarations of results are produced. Many returning officers use diverse methods to display results at count centers, usually by some form of PowerPoint presentation. These are prepared by downloading data from election management software and managed locally at the count center. There is little demand for this process to be integrated into the software as so many different methods are used.

Costs of Technology

The cost and benefits of election management software are difficult to assess in isolation from electoral registration software. When electoral registration software was introduced it was often priced by a direct relationship to the number of voters included on it. This method fell into disuse as being unfair to those electoral registration officers who were paying more for substantially the same service as others dealing with a smaller number of voters.

Although this practice has ceased, it is now not possible to acquire a stand-alone election management software package since they are now integrated with electoral registration packages. Not only that, but packages often are sold complete with the necessary hardware, particularly printers and scanners, which makes an assessment of costs for the election management software difficult to calculate.

For a returning officer with an average number of voters, say 100,000, the initial costs of all software and hardware would be in the region of between USD $60,000 and USD $100,000 with annual maintenance costs of USD $10,000. These figures must be taken in the context that this includes electoral registration and election management software, dedicated printers, and scanners.

It should also be borne in mind there are some 300 electoral registration/returning officers in England with some five or six major suppliers of packages. There is, therefore, a degree of competition and these costs may not be applicable in situations where there is little or no competition.

Benefits and problems

The significant benefit of introducing election management software is that information relating to an election is now held on one linked database. Previously many manual databases had been utilized relating to polling station data, electorate data, and staff data. Some aspects relating to an election were not recorded in databases at all, e.g. data on candidates. This resulted in errors being made when changes were made to certain data elements, e.g. if a polling station location was changed it may not be picked up in relation to some aspects of the election.

Election management software also resulted in individual elements of data requiring input only once. Thereafter, having checked the data, all output was guaranteed to be correct. In some respects this was an advantage since many elements were freshly inputted for each election, e.g. candidate data. In other respects, e.g. staff, data is kept from year to year. Initially this type of data would be accurate; however, over time, data on individuals tends to become out of date. The old adage garbage in – garbage out is still true and effort is required to continually ensure that data held is accurate. It is also vital to manually check the data entered as software output relies on accurate information to maintain integrity.

As the evolution of the use of this software took place, a number of legislative changes also took place, some of which could not be implemented satisfactorily without the aid of software. An accurate assessment of the cost benefits are therefore difficult to calculate independently. What can be judged is that returning officers would usually second a number of extra staff to manage individual aspects of election management. Election management software has tended to reduce this dependence on additional staff which may not have any election management experience. On average, a returning officer may utilize three or four staff centrally to manage an election; whereas, prior to the introduction of election management software, this figure might have been twice as many.

Impact Assessment – electoral design

Objectives of introduction of Election management software

Initially election management software was developed by individual returning officers, with assistance from IT support staff, for their own purposes. These returning officers saw an opportunity to sell their product to other returning officers. Over time, these entrepreneurs formed their own companies selling this software. As these initial attempts to provide a solution for election management were written in MS DOS applications they became superseded by other returning officers coming into the market with Windows-based packages, although some MS DOS based packages still survived.

Responsiveness of Software

The pressure to implement these software packages often came from returning officers, who could see advantages in certain parts of the package. Initially, there was no external encouragement to implement these packages although subsequently the central government offered to make a financial contribution for the initial set up costs.

Perhaps returning officers were overawed by the selling of these products, What became evident was the users of this software needed to have training and knowledge to manage the data held and to customize output for their own needs.

Some staff were able to manage and customize output for their own needs. Others found this difficult and changed their own working practices to fit the software package while others continued to download data into Microsoft Office products to customize output.

When the Windows-based packages came on stream these problems were reduced, although not entirely eliminated. There remains a need for users of the software to customize output. When Microsoft introduced Word and other applications, many staff received training. Today it is assumed people can use such applications; although this may be true for basic operations, many do not understand how to use them, e.g., mail merge functions and data management for customized output.

Since the introduction of legislation on postal voting and subsequent cases of electoral fraud, there is a need to use software to identify possible such violations. This required the capture of images of signatures and subsequent validation of those signatures. Although this issue was not a consideration when election management software

was being developed initially, it is now true that this data capture and validation process could not have been implemented without election management software.

Dispute resolution
The UK, perhaps, is unique in that there is great respect and trust in the role of the returning officer. That respect and trust remains even though there have been some high profile cases of electoral fraud. Those predominately involved in malpractice by political parties did not involve returning officers. Development of the software made it easier to detect potential malpractice. As a result there has never been any questioning of what tools the returning officers use to manage elections.

Political party registration
Political party registration was deemed appropriate for two principal reasons. First, there was a need to ensure that party finances were controlled and regulated and second, the need to ensure that party descriptions did not mislead voters. In this latter category a case hinged on whether a political party describing itself as "the Literal Party" would mislead voters into thinking it was "the Liberal Party," a mainstream political party.

To register, political parties must register a party leader, nominating officer, and treasurer. The party must provide details of its financing and accounting structure and must also provide a copy of its constitution. The requirement to provide the constitution is solely for the purpose of ensuring that financial provisions are in accordance with the declared constitution and is destroyed once the party is registered. A minimum of two persons are required to register a political party to fill the three mandatory posts. Or, if one person fills all three posts another post such as secretary must be filled by a second person. The name of the party or the descriptions of the party may not contain offensive or obscene words and certain words connected with Royalty or high nobility. Apart from these few restrictions no judgment is made on the motives or aims of the political party. This reflects UK's culture of freedom of speech and expression. There has, however, yet to be a case on what might constitute obscene or offensive. The names of the political parties range from the mainstream, Conservative, Labour and Liberal Democrat to the National Front, Communist Party, Mums Army and Kingdom of God Christ's Ambassadors.

Transparency
England has a low level of interest in elections. For parliamentary elections the turnout would be no more than 60-70%; for local elections not much more than 40%; and even less for European elections. There is even less interest in the technological solutions being adopted by returning officers. The use of such solutions was driven entirely by returning officers; although, during the course of development the central government has taken an interest to ensure that electoral registration software produces a standardized output of data which can be held centrally for purposes unrelated to electoral administration and also that a standardized property gazetteer is used throughout the country.

Sustainability
The initial development of election management software possibly was not cost effective as the uptake of these systems grew; the cost, while not reducing, did maintain a consistent price. The benefits initially were to reduce multiple inputs of the same data elements and perhaps more importantly to reduce the scope for errors. Although there is general apathy amongst the electorate, elections at whatever level do have a high public profile. Returning officers saw the introduction of election management software as a means to reduce the possibility of errors. As systems developed and legislation imposed increasingly demanding timelines, the need for software which would scrutinize for fraud increased.

Impact Assessment – Technical Issues
Clarity of the procedures
The first task in setting up an election within the software is to establish a timetable of statutory events and the associated tasks which have no statutory date for completion but which are nevertheless integral to the management of an election. These dates are often found in obscure legislative provisions. The fact that they are automatically determined immediately gives structure to the election project. This is of considerable assistance in planning and allocating the necessary resources to individual tasks.

Party registration
The imposition of a requirement for political parties to register had a marginal effect on reducing the frivolous or mischievous use of names and descriptions; “Liberal Democrats” and the “Liberal Party” are registered as two different parties. Technology was not involved in the decision making process in this respect.

At the point of nomination, returning officers now know exactly what descriptions are allowed. The candidate may use up to six words as a description. Prior to the political party registration process it was often difficult to determine what constituted words. It was common to include initial letters of words to attempt to lengthen the description and it was not unknown for candidates to include advertising with telephone numbers. On the other hand, party activists at the local level are not fully conversant with the rules and what otherwise might be a valid nomination may be declared invalid because the candidate has used an incorrect description.

Providing information to parties
Election management software has assisted significantly in communications with political parties. All notices, letters, etc., are automatically customized to the particular election. Accurate information can be given to candidates and their agents, either as hard copy or by email of relevant voter registrations, notices, and other communication. This is particularly important when the election timetable is very short and a large number of candidates are involved. These tasks now take a minimum amount of time without the need for rechecking the data held.

Candidate Nomination
The candidate nomination process is considerably sped up as qualifications can be checked instantly as can the qualification of the candidates' supporters. This is particularly relevant where a returning officer might have several hundred candidates to process. Candidate agents often act for more than one candidate and often over several years once their details are inputted. Candidate details are not held for longer than the one election even though they might stand for election at subsequent elections. This is because supporter details would change from year to year and would render the data inaccurate.

Campaign Financing
Candidates may spend up to an identified maximum amount directly related to the number of voters in an appropriate electoral area. The election management software provides this information to the candidate, together with the date by which returns of election expenses must be submitted. It is not the task of the returning officer to scrutinize or audit these expense declarations even in the unlikely event the expenditure exceeds the maximum permitted. The electoral commission does scrutinize these returns on a manual basis and technology is not used for this purpose.

The electoral commission also examines party funding and donations. This task falls outside the scope of election management technology and investigations into malpractice are more likely to arise from complaints made by other political parties than those initiated by the electoral commission itself.

Human Resources
It is difficult to isolate the impact of technology on human resources over the past 10 years or so since there have been a number of other changes, particularly in legislation which has probably had more of an impact.

There are four or five major suppliers of election management software and there is an observable tendency for qualified electoral administrators to stay with familiar software. Formal training is usually given to staff when new software is installed and, thereafter, training is often "on the job." The newer Windows-based software is, however, easier to learn than the former MS DOS based systems.

There is an observable difficulty in some areas to recruit staff. This appears to be largely due to the stressfulness of legislative changes, rather than concerns over the technology in use. In general, the use of technology has ameliorated the situation.

Conclusion and Recommendations

In the introductory chapter we cautioned against any one-size-fits-all methodology, however, here, we attempt to provide general guidelines, repeated in summary form as follows:

- Identify the problem
- Invite broad discussion from stakeholders and implementers
- Consider whether there is a need to modify the legal and/or procedural framework
- Provide for required staffing
- If possible, start small with feasibility tests, pilot tests, and developing infrastructure
- Provide adequate time
- If you have never done it before, don't test it during a major election
- Do not introduce technology to compensate for poor procedures

We now will review these guidelines, drawing upon the case studies to illustrate when the guidelines were followed, when they were not followed, and what the results were of the chosen approach. Though it often seems the case, there is no "chosen" approach, but rather an aimless going where the next step leads.

Identify the problem
Before even considering any new technology it is important to begin with a clear definition of the problem or problems that will be addressed. It is often helpful to apply the five W's – who, what, when, where and why – in defining the problem.

- Who does the problem impact? (And at times, who are the key players who contribute to the problem?)
- What is happening now and what should be happening?
- When does the problem occur and when does the solution need to be in place?
- Where does the problem occur and where must the solution be implemented? (i.e. can it be a centralized solution or does the solution need to be distributed to many different places?)
- Why is this problem an important one? (i.e. what are the negative outcomes that result from the way things are currently being done?)

The case studies are filled with examples of attempts to apply technology solutions without a clear understanding of the problem, or cases where the solution missed the central problem.

In the Kenya results transmission case, there was never a clear understanding of what problem the new system would solve. Was the primary purpose of the system to deliver accurate final results or fast provisional results? Was transparency of the process as important as speed of delivery? Should post-election auditability outweigh accuracy, i.e. should the system correct detected math errors or leave them to provide and audit trail?

The Kazakhstan study points out that, although there was a clear understanding that the problem being addressed was potential vote counting fraud, the solution only addressed fraud by local election officials and may have left an even bigger opportunity for centralized

fraud. "Even in the 19th and early 20th centuries, a second reason for election automation was understood. Mechanized voting machines take control away from local election officials. This transfers responsibility from local election officials to the technicians who design and maintain the machines and the officials who oversee them. When there is widespread local corruption, this centralization can be a powerful reform tool, but if the central authorities are not trustworthy, it can be dangerous."[180]

The Kazakhstan system also illustrates the "law of unintended consequences," which states that any change to a complex system may create unanticipated consequences in addition to the intended results. In this case, the intended result of creating a method for more efficient electronic management of the voters list also created the possible violation of the secrecy of the vote. "The use of the same computer system to perform both electronic pollbook functions and electronic ballot initialization allows the possibility that the voter identity could be covertly encoded on the voter's electronic ballot. This would allow a dishonest government to harass those citizens who did not vote correctly."[181] This example illustrates that it is important when trying to solve a problem to make every attempt to anticipate what other problems may be impacted positively or negatively by the solution.

The Ireland example cautioned against being locked into a particular vendor, when procurement is vendor-driven versus procurement driven by actual needs. It is important to recognize that the goals of a vendor may not be perfectly aligned with the goals of the EMB or of democracy in the country. It is the responsibility of the EMB to diligently define the requirements, and then to determine whether it is possible to solve the problem at hand with an existing product, or whether there is a need for custom system development.

The Sierra Leone example points out that sometimes the problem cannot be addressed by any technology. "The investigation that NEC and IFES did into the 2nd round of Presidential elections indicate that it is unlikely that more advanced technology would have significantly reduced the problem of ballot box stuffing that was discovered in that election due to turn out being reported as above 100% in 7% of the polling stations."[182]

180 Kazakhstan Case Study, p 81
181 Kazakhstan Case Study, p 99
182 NEC/IFES (2008) *Further Study into the 2007 Presidential Run-Off Elections.* Submitted 29 February 2008. Unpublished.

Invite broad discussion from stakeholders and implementers
The credibility of an election is determined by both objective and subjective criteria. It is not enough that the electoral process satisfy international standards; the process must be conducted in a way that is acceptable to political parties, civil society organizations, the media and the voters. It is common to talk about developing trust in election systems, but the best systems rely upon transparency and broad participation rather than upon trust. By involving political stakeholders in the planning and decision-making process it is possible to develop a shared vision. Without some degree of consensus, there is significant risk that political factors may derail any system.

In the Kenya results system case study, the "primary reason for failure of the reporting system was political pressure exerted upon ECK…to not report partial provisional results….and before the results were all transmitted for the commission to announce the incumbent president had won."[183]

The Kazakhstan E-Voting case notes that public confidence has been eroded, perhaps irreparably, by party opposition to the system. "From the start, there was significant opposition to the introduction of electronic voting in Kazakhstan. Opposition parties actively urged voters to vote on paper. These opposition campaigns were symptomatic of a general lack of trust in the system. In the 2004 election, a second round of voting was required in some districts, and use of the electronic system fell from round 1 to round 2. In 2005, fewer than 14% of those who had the option to vote electronically opted to do so. A month before the 2007 election, polling data showed that only 22% of the population preferred electronic voting. In the election a month later, only about 6 percent of those who had the option to vote electronically did so."[184]

In Ireland, what began as a process with broad participation disintegrated when it turned into a partisan project. "Indeed, right up to the 18th of December 2003 (the date of the parliamentary committee hearing at which the government party used its majority to support the use of the procured systems), there remained cross-party agreement on both the principle of electronic voting and, with reservations, the procured solution. Thereafter, opposition parties united against the procured solution. . ."[185] The CEV in Ireland notes

183 Kenya Case Study, p 46
184 Kazakhstan Case Study, p 96
185 Ireland Case Study, p 108

that the issues are not merely technical and therefore any possible future electronic voting project should include "a broad public consultation" as well as "a wide range of additional technical tests."

The damage that can be done by failing to build broad support among all stakeholders from the beginning is sometimes not reversible even if an attempt is made later to gain this support. The Ireland case notes that "the point about the CEV is that it was too late. Everything the CEV did and, particularly, how they did it (including high transparency, wide and deep public and stakeholder consultations, independent and expert services procured) to examine the procured solution -- all these things, had they been done by the Department of the Environment as a prelude to the process of introducing electronic voting in Ireland -- would, almost certainly, have resulted in very different outcome."[186]

One way to get broad support from the political parties is to create systems that facilitate the flow of information to those parties. In England, "Election management software has assisted significantly in communications with political parties. All notices, letters, etc., are automatically customized to the particular election. Accurate information can be given to candidates and their agents either as hard copy or by e-mail of relevant voter registers, notices and other communications."[187]

Consider whether there is a need to modify the legal and/or procedural framework

The Kenya case study described a system that was capable of displaying election results in a variety of ways, but no clear procedures were defined for efficiently getting the results from polling stations to the reporting center. The case study points out that "as is often the case in the failure of system, the greatest weakness in the vote reporting process hinged not on any problem with the technology but with policy and procedures."[188]

In the Armenia case study, IFES made many recommendations for streamlining the reporting protocols, but "Unfortunately, the electoral law spelled out every detail of the process to be used in the regions, including the number of protocols to be completed, the order in which they should be completed, and the information required to be included on each protocol. Suggestions to include additional information such as the mathematical validation described above met with objections that this is not in the law."[189]

186 Ireland Case Study, p 112
187 England Case Study, p 146
188 Kenya Case Study, p 43
189 Armenia Case Study, p 64

Implementing any new system often requires a streamlining of manual procedures and may cascade into a need to change one or more laws. This process can stall or even completely derail technology implementation.

Provide for required staffing

Recruiting and retaining competent technology staff is key to every case study included in this guide, but is particularly mentioned in the Guyana case, which points to a non-financial obstacle: "Following the 2001 general and regional elections, the position of IT manager changed hands on a number of occasions, each time a person from outside the organization. This was largely due to perceived political bias on the part of whatever Guyanese the GECOM appointed to this position. This lack of continuity inhibited in the major capacity development during this period. This was addressed in April 2005, when an international consultant was engaged to oversee the department during preparations for the 2006 elections."[190]

If possible, start small with feasibility tests, pilot tests, and developing infrastructure

In Sierra Leone, the lack of infrastructure dictates some of the parameters of the system, particularly indicating a more centralized approach: "A main problem concerns using any form of computer technology outside of the capital, where no power grid exists in that there are very few people with computer expertise."[191]

Both the England case and the Guyana case provide examples of an evolutionary approach to systems development, where the understanding of the problem grows over a slow development process. This possibility usually requires in-house development or at least a close, long-term relationship with a service provider. Whenever this approach is possible, it provides the greatest flexibility since it allows any modifications to the system to be done without relying upon (and paying) an external vendors. The system also is allowed to grow with advances in national infrastructure and/or changing technologies.

Provide adequate time

In the Kenya results transmission case, inadequate time was given for procurement and outsourced development of a system to do data entry in constituency offices. When the vendor failed to meet the agreed-upon, but overly aggressive, schedule, the EMB was forced to throw together a results system in 10 days that provided at least minimal functionality for reporting provisional results. The Kenya case points out a number of instances in which late planning sabotaged the system in advance of its use: "By the time ECK began to discuss

190 Guyana Case Study, p 120
191 Sierra Leone Case Study, p 132

a results reporting system, their Supplies Department had already purchased results reporting forms identical to those used in previous elections….Late delivery of specifications and contract contributed to a failure to develop the WAN-based system in time for deployment. A last-minute request for a fax-based system did not allow adequate time to clarify whether the system was to be used for reporting preliminary provisional results or final verified results."[192]

In Indonesia, although the SMS reporting system was proposed at a time that would have allowed extensive testing, the EMB's delayed decision jeopardized the system: "When the initial concept was introduced to KPU in early 2008, little interest was expressed in implementing the system. Then in January 2009 with elections rapidly approaching and with the lack of any alternative, KPU contacted IFES to explore whether there was still time to implement an SMS reporting system."[193]

In Kazakhstan, "The election law established a State Commission for Acceptance of the Electronic Electoral System, but the commission was only formally authorized September 14, 2004. This was just days before the September 19, 2004 parliamentary elections, where 961 polling places were equipped to use the system. The final scope of the first trial use was only decided on September 17, just two days before the election[194]."

In Armenia, "In January 1996, IFES was invited to recommend improvements for the election technology infrastructure. With elections scheduled for March 16, less than 8 weeks after the IFES assessment, there was inadequate time to address any technology issues beyond the vote reporting system."[195]

If you have never done it before, don't test it during a major election

The Indonesia results tabulation system using intelligent character recognition (ICR) may have been an excellent application of technology to solve the problem at hand, but it was implemented on a wide scale without adequate testing. "Planning for the ICR system began very late with initial demonstrations and proof-of-concept testing conducted in January and February 2009, three months before Election Day. The contract was awarded in March, allowing minimal time for software configuration and testing, and no time for training of operators"[196] Because there was no time for testing, the EMB did not discover a fatal flaw until they tried to actually use the system. "The ICR system was a complete failure with most offices unable to successfully

192 Kenya Case Study, p 46
193 Indonesia Case Study, p. 55
194 Kazakhstan Case Study, p 91
195 Armenia Case Study, p 64
196 Indonesia Case Study, p 58

scan a single form. . . By the time the forms arrived at the Kabupaten office, exposure to moisture and humidity had caused the edges of most to curl so badly that it was impossible to feed the formthrough the sheet-feeder on the scanner."[197] This flaw, related to using a light-weight paper, should have been detected in early pilot testing and could have saved the system from an embarrassing failure.

Do not introduce technology to compensate for poor procedures
The Kenya case study points out that the 2002 election and the 2002 referendum "revealed many serious flaws in the production of voter registers, the distribution of materials, the counting procedures, etc., and these flaws were overlooked because of the outcome of voting."[198] "The greatest weakness in the vote reporting process hinged not on any problem with the technology but with policy and procedures."[199]

General Principles
In addition to general guidelines for election technology implementation there is one overarching theme that recurs throughout the case studies – the need for transparency at every stage of the process. This includes transparency in the formation of procedures, the definition of what problem or problems will be addressed, the process of deciding upon a technological approach, the procurement of all related systems and services, and perhaps most importantly, in the operation of the technology.

The requirement for transparency is consistent with the philosophical debate outlined in the preface:

- Plato expresses a belief that civic wisdom, *politike techne*, "respect for others and a sense of justice," is distributed equally to all.

- Martin Heidegger emphasizes "what is decisive in techne does not lie at all in making and manipulating nor in the using of means, but rather in the revealing".

- Jacques Ellul cautions against an "idolatry of efficiency", observing that "technology has become . . . the defining force of a new social order in which efficiency is no longer an option but a necessity imposed on all human activity."

197 Indonesia Case Study, p 58
198 Kenya Case Study, p 40
199 Kenya Case Study, p 43

The implication for elections of this common philosophical theme is that technology should be used to reveal the essential events and activities of the election, rather than serving only to boost efficiency. Any process that hides the inner workings from the eyes and understanding of observers (including proofs of accountability that can only be followed by someone with a degree in engineering) is essentially antithetical to democracy.

The Electoral Commission of Kenya ignored recommendations of both IFES and UNDP to report detailed vote counts from the polling stations, allowing auditability. The resulting mistrust was one of the principal factors behind the violence that spread throughout Kenya in the days following the election.

In Kazakhstan, "The secret legal requirement to which the Sailau system was certified may be benign, but since it has never been revealed, we cannot be sure of this."[200] The lack of trust in the system is reflected in the number of voters (6%) who chose to vote electronically in 2007.

Kazakhstan still failed to provide detailed results that should be a central goal of any voting system. "The e-government web site of the Kazakh Central Election Commission is very well designed, but it does not provide access to either official or unofficial election results at the polling place level. Kazakh law requires paper copies of the polling place results be posted at the polling place. If voters could compare these results with the official results from the Central Election Commission, they could check that the national results correctly incorporated the results from their polling places. Unfortunately, as configured in the past three Kazakh elections, the aggregation of polling-place election results has not been conducted transparently."[201]

The "lessons learned" remarks in the Ireland case study notes that "transparency is simply not negotiable -- even bad test results can be overcome but failure to disclose does irreparable damage to trust and confidence."[202]

Guyana abandoned a proprietary system, and explains that "this change was motivated both by the difficulty in providing transparent stakeholder access to the data contained in a proprietary system and by a desire to have a unified data store for ease of reporting."[203]

200 Kazakhstan Case Study. p 100
201 Kazakhstan Case Study, p 100
202 Ireland Case Study, p 113
203 Guyana Case Study, p 120

Elections are based upon a respect for the rights of every individual to have an equal voice in selecting leaders who will represent his or her values. This right is enshrined in a number of international and national documents, most notably the International Declaration of Human Rights, which states that:

"The will of the people shall be the basis of the authority of government; this will shall be expressed in periodic and genuine elections which shall be by universal and equal suffrage and shall be held by secret vote or by equivalent free voting procedures."[204]

To be a stakeholder in the electoral process is to take on an awesome responsibility to make and support decisions that preserve this right. Because we are individuals, and that individuality extends to our cultures and our countries, there are many varieties of legitimate and appropriate electoral systems, reflecting the local contexts in which elections are held; however, all of these systems reflect some common principles. The best implementations of election technology are those that reflect universal principles of fairness and equal suffrage. Any successful partnership between elections and technology must place principles of fairness, equality, broad participation, and transparency first and foremost, and adopt principles of technological efficiency only when they can effectively serve these primary democratic principles.

204 The International Declaration of Human Rights, Article 21.3, ohchr.org. http://www.ohchr.org/EN/UDHR/Pages/Introduction.aspx. Retrieved 2010-04-18

Annex 1

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[of the first report of the Commission on Electronic Voting, December 2004]

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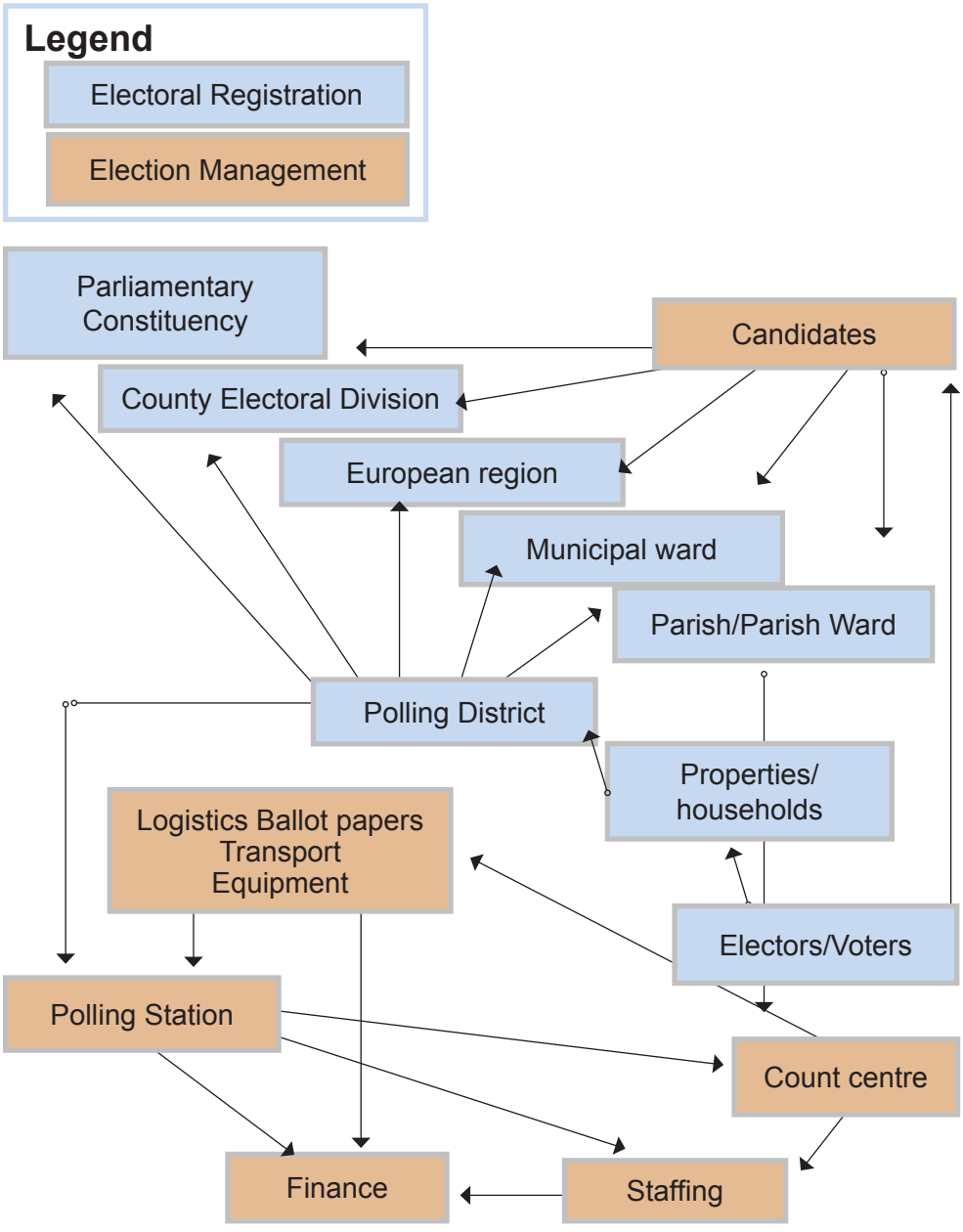
Annex 2

The British Electoral Registration Process



Annex 3

Typical output from Election Management software

Note: this is not an exhaustive list
The International Declaration of Human Rights, Article 21.3, ohchr.org. http://www.ohchr.org/EN/UDHR/Pages/Introduction.aspx. Retrieved 2010-04-18

For electors
Registration forms
Applications for absent votes and acknowledgements
Polling cards
Absent voting forms
Notices for candidates nominated
Notices for situation of polling stations

For Political parties and candidates
Notice of election
Voter registers
Notice of appointment of agents
Forms for return of election expenses
Absent voters lists
Various notices to agents
Notice of result of poll

For staff
Letters of availability
Letters of appointment
Expense claim forms
Payment information
Advice to staff on materials issued

Logistics
Artwork for ballot papers
Advice on quantities of ballot papers
Verification checking
Data for printing postal vote packs
Transport of equipment schedules.

Administrative
Assessment of equipment requirements
Summary of expenditure

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