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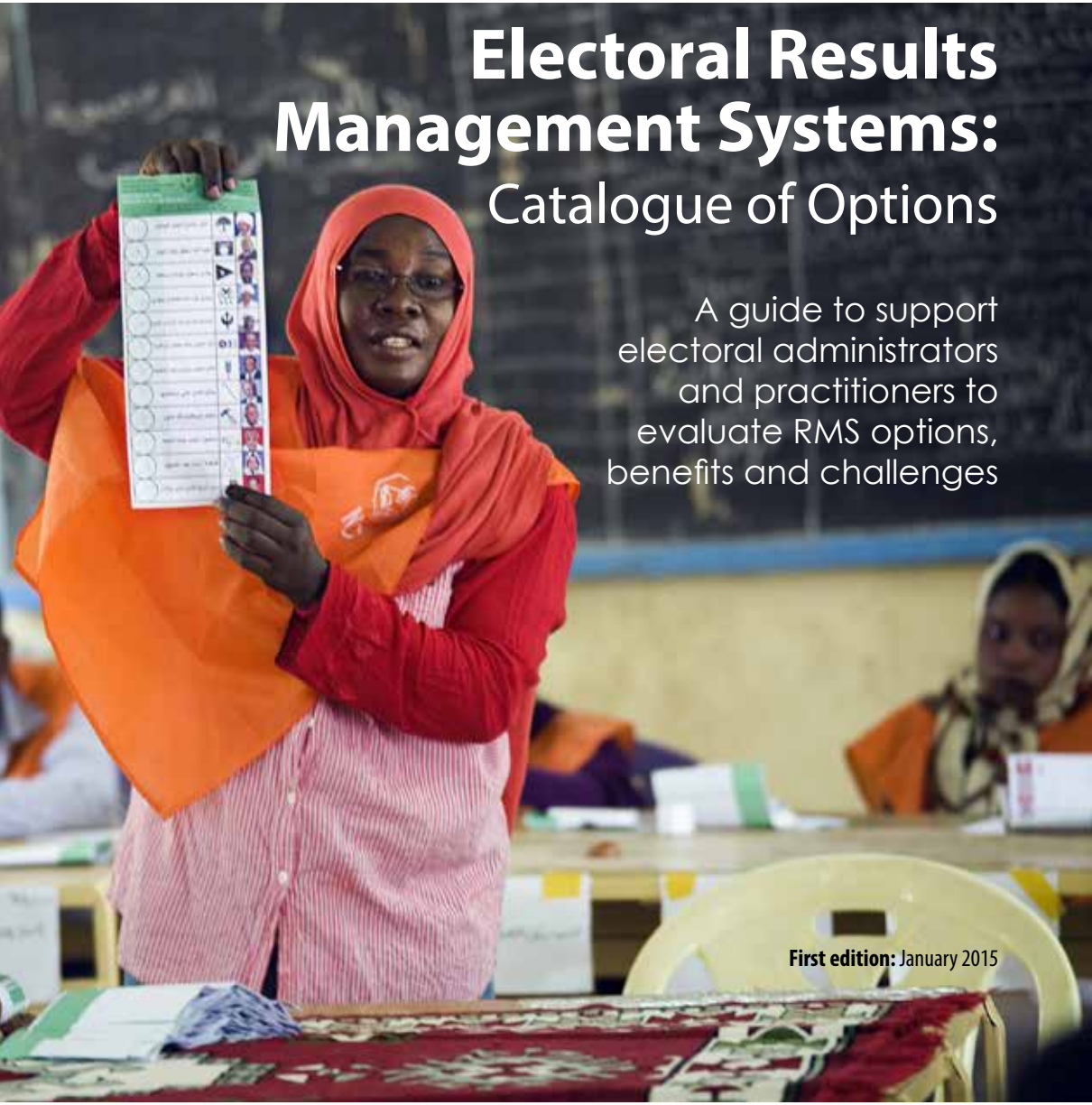
Electoral Results Management Systems:
Catalogue of Options

A guide to support electoral administrators and practitioners to evaluate RMS options, benefits and challenges



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With the support of:
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Acronyms and abbreviations

API	Application programming interface
BED	Departmental Electoral Office (French acronym) – Haiti
BEK	Communal Electoral Office (French acronym) – Haiti
BV	Block vote
CDI	Conflict Dynamics International
CEO	Chief electoral officer
DO	District officer
E-voting	Electronic voting
ECB	Election Commission Bangladesh
EDR	Electoral dispute resolution
EMB	Electoral management body
EoI	Expression of interest
EVM	Electronic voting machine
FIN	Finance
FPTP	First-past-the-post (electoral system)
HC	High court
HR	Human resources
ICT	Information and communication technology
IEBC	Independent Election and Boundary Commission (of Kenya)
IEC	Independent Election Commission
IFES	International Foundation for Electoral Systems
IT	Information technology
NDA	Non-disclosure agreement
NDI	National Democratic Institute
OPS	Operations
PBV	Party block vote (electoral system)
PC	Polling centre
PR	Proportional representation (electoral system)

PRO	Procurement
PSO	Procurement Support Office
PVT	Parallel vote tabulation
RFP	Request for proposal
RFQ	Request for quotation
RMS	Results management system
UNDP	United Nations Development Programme
RTS	Results tabulation system
SNTV	Single non-transferable vote (electoral system)
TRA	Training
TRS	Two-round system (electoral system)
UNOPS	United Nations Office for Project Services
USAID	United Stated Agency for International Development
VPN	Virtual private network
VVPAT	Voter-verified paper audit trail

Glossary

There is no authoritative set of definitions for many of the terms below. Elections are a global practice with terminology that may vary from country to country, and at times within countries. The purpose of this glossary therefore is not to establish a set of authoritative definitions, but to support the coherence of this manual. A number of terms have more than one meaning, depending on the context.

Term	Meaning
Aggregation	1. The votes within results forms from multiple polling stations or multiple ballot boxes are added together to give a cumulative total for each candidate, party or referendum option. Synonym for tabulation, consolidation See also: disaggregation
Ballot reconciliation	Where possible, the number of ballot papers provided to a polling station, the number of unused ballots, the number of ballot papers spoiled or rejected, as well as the valid ballots included in the count are typically recorded at the polling station level. All this information is necessary to permit a full accounting for all ballot papers used in an election. This accounting is called ballot reconciliation. In some cases, a single results form (a term also referenced in this glossary) contains both ballot reconciliation and the results of the count of the ballot box. In other cases, ballot reconciliation is done on a form separate from the results form.
Certification	Certification can have one of the following meanings, depending on the context: 1. Certification refers specifically to a certificate or official document that is issued to a winning candidate by the returning officer or other electoral official. 2. Certification refers to a process of formally stating that the results announced by a returning officer or other electoral official have been validated and are correct. If an electoral management body (EMB) is the authority certifying the election results, it is often required to gazette the result and the winners. In some jurisdictions, the EMB is only authorized to announce the final results while the judiciary (usually a specific court) is charged with certification of the results. Accurate and reliable certification is facilitated by a transparent and accountable results management system (RMS).
Complete	Data containing results from every polling station that require tabulation may be said to be complete.

Consolidation	Consolidation can have one of the following meanings, depending on the context: 1. The combination of ballot papers from multiple polling stations or ballot boxes prior to counting. 2. The bringing together of electronic results from multiple electronic voting machines. 3. The votes within results forms from multiple polling stations or multiple ballot boxes are added together to give a cumulative total for each candidate, party or referendum option. Synonym for aggregation, tabulation – although in some countries consolidation and aggregation are used for different processes ('consolidation' referring to putting together ballot papers of different polling stations prior to counting, and 'aggregation' referring to the addition of the different results post count).
Count	Counting of ballots at a polling station or at a special location (sometimes called a count centre) to which ballot boxes are taken after polling is completed. The votes cast for each candidate, party or referendum choice are counted following the determination of validity of each ballot paper.
Disaggregation	Refers to taking a total number of votes cast for a candidate, party or referendum choice and breaking it into underlying components, usually by geographic or electoral district. A results management system (RMS) should allow stakeholders to disaggregate down to polling station level, except where consolidation of ballot papers has been done for security or procedural reasons.
Incomplete	See: partial. May also refer to results where missing data are not material (see: materiality).
Interim	EMBs may release provisional or verified results as they are received, on fixed schedules or by geographic region (among various possibilities). Any results released by the EMB prior to the final declaration of official results may be described as interim. See: partial and preliminary.
Materiality	If the total remaining outstanding votes cannot alter the outcome, they may be said to be 'not material' to the outcome. Materiality is difficult to determine in more complex electoral systems.
Official	Relates to the provenance of results data. Results coming from an EMB may be said to be official. These may be partial, provisional, preliminary or final – it is their source that makes them official.
Partial	Data (usually aggregated or consolidated) that do not include results from all polling stations or constituencies.

Preliminary	Results, either complete or incomplete, whose accuracy has been checked by the EMB. Once possible disputes have been settled the results become final.
Provisional	Results whose accuracy have not been checked by the EMB. They may be complete (that is to say, results may have been received for all polling stations), but may not have been fully verified.
Publication	Making election results publically available. Publication may be done on paper or in electronic format (or both).
Quarantine	Any electoral materials or results that have been set aside in order for possible or claimed anomalies or errors to be investigated. May be entire ballot boxes or documents otherwise related to an election.
Recount	The repeat of a counting process. A recount may be automatic (where certain criteria, typically a narrow winning margin, are met); on request (where political parties or candidates or their agents may be permitted to ask for a recount); or upon an order by pertinent judicial authorities to investigate allegations of irregularities.
Results form	A paper form (sometimes more than one form, see ballot reconciliation in this glossary) completed by the presiding officer, usually witnessed by party or candidate agents and citizen or observers. This form – also known as statement of the vote, results slip, and results protocol – is usually the first document created in a results management system (RMS). Copies of the results form may be posted at the polling station (or counting centre) and may be shared with political party or candidate agents as well as citizen observers.
Tabulation	Tabulation can have one of the following meanings, depending on the context: 1. The votes within results forms from multiple polling stations or multiple ballot boxes are added together to give a cumulative total for each candidate, party or referendum option. 2. Refers to the inclusion on a single document (or presentation), usually in tabular format (hence the name), the results from multiple polling stations (or ballot boxes) for each of the candidates, parties or referendum options. Also a synonym for aggregation. Synonym for aggregation, consolidation

Transparent	Refers to a core condition for all components of an acceptable, reliable and effective electoral process overall. For each document and data point in an RMS, the EMB and stakeholders must be able to see, in a timely fashion, where it came from; which electoral official is responsible; whether it is interim/provisional/partial or final/verified/certified; and the underlying (source) data for all consolidated/aggregated results must be available. Further, where technology is used in an RMS, its procurement, development and implementation should involve all electoral stakeholders in an appropriate manner.
Verified	Results whose accuracy and authenticity have been checked to the satisfaction of the EMB may be said to have been verified. The same source results may be consolidated at multiple layers (for example at constituency, province and national levels), requiring each consolidation to be verified. Also known as 'validated'.

Introduction

North Darfur Woman Votes in Sudanese National Elections
UN Photo/Albert González Farran

In assessing the credibility of elections, attention has for the most part focused on the activities leading up to an election, as well as the voting and counting. Indeed, three stages of the electoral process that take place before votes are counted have long dominated the discussion; namely (1) voter registration, (2) candidate registration and (3) the voting process. The general consensus has been that an election cannot be deemed to be credible without all three of these phases having been carried out correctly.

In general, insufficient focus has been placed on the activities that take place after the counting of votes. Not enough attention is consistently paid to the planning of a robust, accurate and transparent results management system. Yet as the Kenyan elections of 2007 clearly demonstrated, a significant delay or a lack of confidence in the results can derail an entire electoral process, rendering irrelevant the success and acceptance of all the other stages. A key lesson must be learnt: if there is to be trust, then transparency, accuracy and accountability are essential.

A similar situation occurred in the aftermath of the Jordanian 2013 House of Representatives´ elections. Unlike in Kenya six years earlier, however, the confusion that arose from announcing different provisional results was addressed quickly and efficiently thanks to the electoral management body´s own electronic verification system, which detected the differences and allowed for a proper investigation to take place and ended in the release of final results. The lesson learnt in Jordan was that verification systems should be in place and properly implemented, including a precise timeline that outlines the various steps needed to verify results before releasing preliminary results. Also, all relevant stakeholders need to be aware of such systems.

A focus on election results management systems ensures that equal consideration is given to activities taking place in the aftermath of polling. An election results management system (RMS) is defined as the process by which an election authority counts, tabulates, aggregates and announces the results of an election, which starts immediately after the closing of polling and ends with the final results. Intrinsic to any successful RMS is the continuation of transparency right through to the end, including during and after votes are counted. Also extremely important is how an electoral dispute resolution system is managed regarding any complaints and challenges to the results at various stages.

Results management systems are always context-specific and thus vary from country to country. They can be characterised by limited or extensive use of technology. Their structure and composition take into account legislation, political environment, local infrastructure, technical capacities as well as both financial and human resources. Some must adapt to complicated electoral systems that require additional levels of calculation to establish the end results. Others must have the ability to coordinate numerous different layers of electoral management bodies (EMBs) involved in a process (national, regional, district, local, polling centre, polling station, etc.).

There are also many new challenges. In an era of instant information, the electorate has come to expect results considerably faster than in the past. As a result, EMBs are under great pressure to deliver quickly. It can be difficult to accommodate demands for an EMB to produce swift results without compromising the accuracy of the RMS.

Another relatively new challenge stems from party agents, citizen journalists and domestic and international observers demanding access – and rightly so – all the way through the electoral process to consolidation and aggregation. Yet the introduction of information and communication technologies (ICTs) is prompting the need to change the methodologies used by these and other stakeholders to follow the results management process. Measures should be taken to accommodate their needs and to prevent suspicion that the system is susceptible to manipulation.

An important point to remember in election administration is that the environment has a strong impact on what is possible, as well as what is prudent. Thus, although efforts should be made to identify an ideal and perfect solution, decisions should be guided not only by what is desired but by what is realistically viable.

This publication does not represent United Nations policy of official positions. Instead, is intended to be a catalogue which offers a description of the main RMS options as well as their benefits and challenges. The aim of the publication is to support electoral administrations to take informed decisions when evaluating a potential RMS to be used.

What is a results management system?

Ballot for the Afghanistan 2005 elections
Source: www.iec.org.af/jemb.org/eng/photo/Counting%20Center/target4.html Election Commission of Afghanistan

In short, a results management system (RMS) contains all elements related to the count, aggregation, analysis and publication of votes once they have been counted at the lowest level. A holistic approach to electoral system design requires closely integrated planning of both vote counting and results management. Although vote count can be considered to be part of a an RMS, this publication does not discuss issues around vote count in detail.

Instead, it primarily reflects on specific issues regarding vote count in regards to its implications for results management.

Also important to note is that some electronic voting systems already include the aggregation of results and therefore the boundaries between count and aggregation can be easily blurred.

2.1 Developments over time in handling results

> *Proper emphasis has been placed in recent decades on inhibiting ballot stuffing using mechanisms such as transparent ballot boxes; full reconciliation of ballot papers; and by the presence, in polling stations, of candidate and party agents and observers. As it has become harder and harder to effect polling station level fraud, the focus of those who seek to manipulate electoral outcomes has shifted to the results process. Results management systems are a response to this threat*[1].

When polling has taken place in multiple locations, it is necessary to have a system to enable all results from the various locations to be added up to provide the overall result or results to determine the elected representative[2]. Over time, the development of such systems moved from gathering results on paper and adding them up to (for example) sending paper forms by facsimile and completing the aggregation with the use of calculators at various locations, depending on the level of election (local, district, regional, national).

1 EU-UNDP Joint Task Force (JTF), Thematic Workshop on ICTs and Elections; p.76 of workshop summary report. The workshop was held in Mombasa, Kenya from 5-9 March 2012.

2 Here and elsewhere in this publication, 'results' of an election or elections should be understood as referring to both the selection of representatives and decisions on specific referendum issues (which are not usually tied to specific individuals). This one term is used for both such instances for the sake of simplicity.

Manual aggregation was, and is still, often used in parallel with the introduction of ICT options. For example, manual paper-based aggregation has been done at the same time as results from polling stations are also aggregated with computers. Both options may be used in order to release provisional results soon after polling closes while also ensuring the internal verification purposes of the election administration.

Similarly, the appearance of electronic voting machines (EVMs) did not initially have a big impact on the RMS process. Often, the aggregation of results has remained the same, with in some cases manual aggregation still used to obtain results.

More recently, the electronic transmission of results using different networks – e.g., the internet, either public or private networks or radio transmissions – provides further options as to how to adapt an RMS. Different methods may be used depending on, for example, how the results forms are transmitted (e.g., via the internet through scanned copies or using results templates in computer terminals).

The new and ever-evolving options can and will be important and useful. Yet as indicated above, most countries today still use some sort of manual results management system, and paper copies still play a major role. Final election results are mostly based on the aggregation of results from paper copies, which serve as 'originals' and are the ones granted legal status in court hearings. Paperless voting has opened the door to a fully paperless aggregation of results, but such methods also pose many challenges, both technically and culturally.

Over time many new approaches have been devised. These innovations have often been fuelled by the opportunities that evolving technology has made possible. However, rather than see the rise and fall of a 'favoured' RMS as new technological options emerge, there has been a diversification of the approaches that are used. This publication aims to shed light on the various models available and encourage moves forward toward adapting and using them. At the same time it cautions against the use of new technologies that may overwhelm the authorities, citizens and other stakeholders.

2.2 Various elements affecting an RMS

2.2.1 Election systems

The number of options (candidates, parties or groups against which voters mark their choices) presented on a ballot, and subsequently upon the results forms, has an important impact on the complexity of the aggregation of results. The number of options is in part determined by the electoral system used. If the electoral system is based on displaying candidates and there is a large district magnitude, there is a greater chance that more options need to be listed.

When there are more options to tabulate, there is naturally a larger possibility of human errors in data entry and addition. Further, the more options there are, the longer it takes to process an individual results form.

As an example, the Afghanistan 2005 parliamentary and provincial council elections were conducted with an SNTV (single non-transferable vote) electoral system. Three provinces each required ballots with seven pages of candidates. In addition to making it difficult for many voters to exercise their right to vote, that step also further complicated the count and aggregation of results because the number of candidates was so large (an average of 80-plus candidates per province).

2.2.2 Design of results sheets[3]

The paper form used to capture the result of a count goes by different names in different countries – including form, sheet or protocol. But the purpose of such forms remains the same: to record the details of the polling and counting processes just completed and to have that record signed by the official who completed it, together with any political party or candidate agents as witnesses.

The information on the results form is the foundation of an effective RMS, regardless of whether the system is manual, a hybrid manual/electronic or automated. Where electronic voting systems are deployed, the report equivalent to the results form naturally lacks ballot paper reconciliation information. Nevertheless, it should include all available information in order to fully account for all activities undertaken and reconcile with any paper mechanisms in use (for example, checking off voters' names on a voter list).

Reconciliation information

The overall emphasis of electoral processes is naturally on the number of votes cast for each candidate (or party or referendum option) – elections are competitions, after all, and most people want to know the winner. However, for a results form to contribute in a meaningful way to the effectiveness of an RMS, it should go further and record all the information relating to the conduct of the poll at that polling station.

3 The ACE Project includes a section on form design, available at http://aceproject.org/ace-en/topics/vo/voc/voc04/voc04b/.

Data suitable to be recorded[4] may include:

- name and code[5] for the polling station;
- location of the polling station;
- name and code of the electoral district. (Depending on the country and election, the electoral district may be ward, constituency, district, county or province.);
- which election is reported on the specific form (especially important when multiple elections are held on the same day);
- the number of registered voters at the polling station;
- the number of signatures counted from the station voter register;
- the number of ballot papers received at the polling station. When there is provision for top-up of ballot papers[6], the form should reflect whether this did or did not take place, and the quantity;
- the number of spoiled ballots;
- the number of unused ballots;
- the number of rejected or disputed ballots;
- the total number of valid ballots;
- the name and specific wording for each candidate or party or referendum option listed, together with the number of votes cast for each candidate or option;
- the name and signature of the official who is completing the form;
- the name and signatures of any political party or candidate agents who witnessed the count and wish to attest to the accuracy of the form's contents. Provision may be made for recording a decision by an agent to abstain for signing the form;
- depending on the legal provisions, any additional information (for example, votes cast by polling officials or security personnel not registered at the station, provisional or tendered balloting, etc.); and
- if appropriate, the serial numbers on electoral seals or tamper-proof envelopes used to protect electoral materials or results in transit to or from the polling station.

This additional information should make it possible to reconcile all ballot papers – that is, the form should contain all the information necessary to account fully for all received ballot papers. Many paper results forms include fields where the result of reconciliation calculations should be captured. Further, many electronic RMS data entry forms also conduct such calculations and flag any anomalies.

4 For an example, see in Annex 1 the results sheets used in Haiti in 2006.

5 Codes are as important as names because, for example, in any list of polling stations there are multiple entries such as 'primary school' or 'secondary school'. Therefore, both code and name are essential elements of form design to eliminate ambiguity.

6 Top-up in this context refers to the possibility of having additional ballot papers delivered to a polling station due to an unforeseen large number of voters.

The information recorded on the results form can be used to support the aggregation process in a number of ways, including:

- to help identify if there were significant errors with the completion of the results form and potentially with the counting;
- to help identify if there were significant errors with data entry of results – if that method was undertaken – by providing multiple figures to compare; and
- to help identity if there was tampering with the results forms (e.g., if someone wrote on the form to change the number of votes), because such changes might mean a form no longer reconciles.

Combined or separate results and reconciliation forms

Different circumstances prevail in each country and the results form should be adjusted accordingly. Some countries capture the information on more than one form – with a presiding officer's form focusing on the ballot reconciliation and a results form capturing the results of the count of contents of the ballot box. The principles of accountability and transparency should be the guide, with the focus on what information is necessary to deliver on these requirements.

Generic or custom results forms

When an EMB has definitive[7] databases of polling stations, voter registration, political parties and candidates (including independent candidates), the possibility exists to print customized results and consolidation forms. This saves time on election day, can reduce errors and probably inhibits manipulation. The downsides are the logistical challenge of getting the correct form to each polling station and the additional burdens on the print house.

Designing consolidation forms for various levels (polling centre, district, state, national):

Bangladesh *case study*

Bangladesh has piloted a hybrid RMS in several iterations over recent electoral cycles, but its results system is officially a paper-based one. At each polling station, the presiding officer completes a form such as the one shown in **Figure 2**.

7 This is a greater challenge than it appears. Polling schema are notoriously difficult to pin down, particularly in large countries with decentralised EMBs.

Figure 2. *Polling station-level results form, Bangladesh*

Source: Election Commission Bangladesh (ECB) website

The form is then sent to the next level, usually an upazila (sub-district) office, where an assistant returning officer conducts the initial tabulation. Thereafter, the results are sent to the returning officer and a final tabulation as illustrated in **Figure 3** is completed. While the consolidation is sometimes printed from a computer application, that is a recent and non-binding innovation – paper is paper, and the signature of the official is visible on every page as well on the final sheet.

Figure 3. *Example of tabulation by returning officer in Bangladesh (one row per polling station)*

Source: Election Commission Bangladesh (ECB) website

While the dissemination of the paper forms is initially limited to the location of their creation (the polling station, the returning officer, etc.), detailed results are usually visible after the electoral event (depending on the electoral event). In some cases[8] just the results are visible, while in other cases[9] scans of the underlying paper forms are posted for public scrutiny.

Occasionally in Bangladesh, data are available online only to consolidation level. But often, as illustrated in **Figure 4**, further links to polling station level results are provided (in this example, in PDF format).

Figure 4. *Consolidated results in Bangladesh, with hyperlinks to PDF of polling station results form*

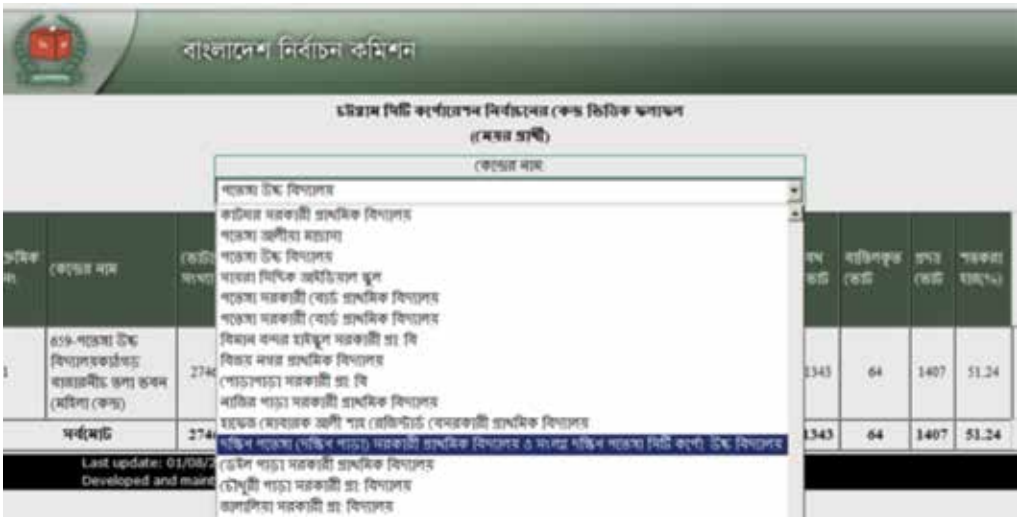
Source: Election Commission Bangladesh (ECB) website

In other cases, polling station level results are offered on the Election Commission Bangladesh (ECB) website in data format, selected from a combo-box, as illustrated in **Figure 5**.

8 For example, Gazipur City Corporation Election 2013. See http://123.49.39.5/ems/result_show1/web_details.php?s=17&c=M (in Bengali).

9 For example, 9th National Parliament by-election, Bogra-7, Bangladesh. See http://123.49.39.5/result/byelection/centerwise_pdf/bogra7_03042009.pdf (in Bengali).

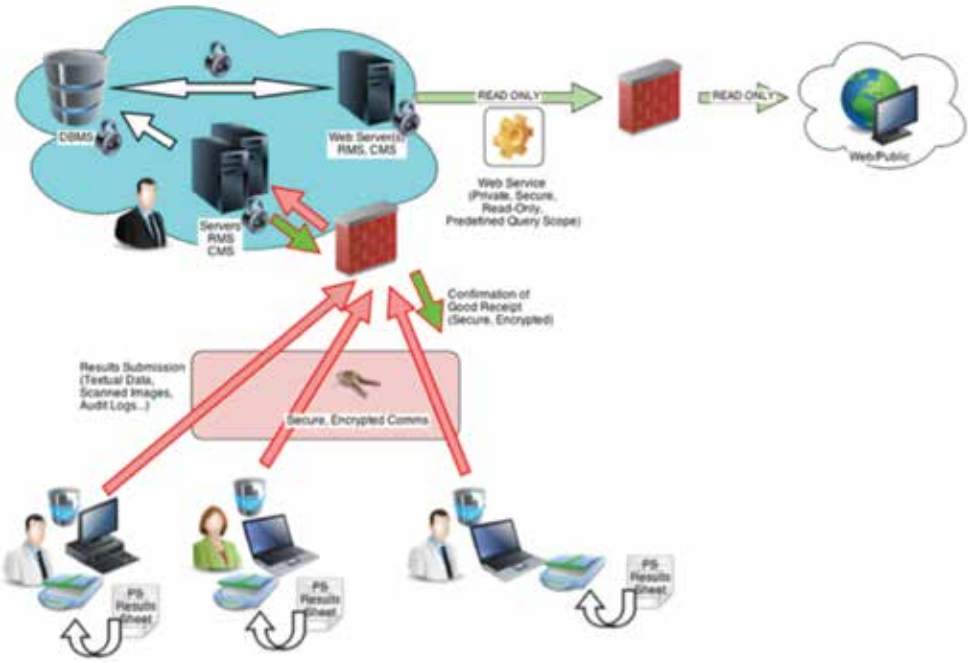
Figure 5. *Polling station results available in data format only*



Source: Election Commission Bangladesh (ECB) website

ECB, with the support of the United Nations Development Programme (UNDP), created and nationally piloted a more sophisticated and robust RMS for the January 2014 elections. Building on earlier successes, the new RMS continues to operate in the hybrid mode, with paper results remaining official. The new RMS was deployed at 587 upazila offices (aggregation points at sub-district level, staffed by assistant returning officers) and 70 offices of returning officers.

Figure 6. *Bangladesh's hybrid new RMS scheme*



2.2.3 Verification requirements

The accuracy of the results is paramount. Therefore, measures to verify the correctness of election results are essential to a comprehensive and reliable RMS.

Verification can be done in a number of ways, with either manual or electronic approaches. In general, verification can be conducted by either, or a combination of, the following two ways:

- Comparing results data that have been collected through different channels or at different levels of aggregation. The EMB investigates discrepancies. For example, in practice this might mean comparing results that have been entered into a computer by polling centre staff against those entered though data entry in a centralised results centre.

- Taking measures to ensure that the tabulation through one channel is correct. For example, in practice this might mean having each results form data-entered into a computer system multiple times in a centralised results centre and comparing the database records for discrepancies.

However the verification system is designed, it must be implemented in a coherent and consistent manner.

Where data are compared to conduct verification, all sets should hold a relatively high confidence; otherwise there may be many inconsistencies. Given that each inconsistency requires review, the entire process can be delayed beyond an acceptable point when too many reviews are required.

Any transcription activity can result in inaccuracies; people inevitably make errors in copying information. That is the case both in regards to copying information between paper forms as well as from paper forms to electronic machines. As such, safeguards should be introduced to identify and resolve inaccuracies. Some typical methods include the following:

- Double-blind data entry, which is broadly described as two data entries of the same form in the same system. The data from both entries are compared for inconsistencies, with corrections made if mistakes are found. Having each step conducted by two different individuals who cannot communicate with each other helps prevent collusion to change results.
- Quality control. Assigned persons review the polling station form against the relevant information that has been entered to ensure they match. This is run against all forms, or a set percent of forms, depending on other measures.

VERIFICATION CASE STUDY: **JORDAN** 2013

For the elections in Jordan in 2013, the results of each polling station were recorded at individual stations in results sheets10 while at the same time introduced in a computer connected to the main server in the capital, Amman. This allowed Jordan's Independent Election Commission (IEC) to (1) release provisional results and (2) verify that the totals provided later from district levels coincided with their provisional results. Also, if the totals do not match, the system allows IEC to request investigations to determine the reason(s) for the discrepancy and to clarify the official results.

10 Because a parallel electoral system was used, two sheets had to be filled in at each polling station countrywide.

In Jordan, entry of the individual polling station results was required to take place at district level so as to enable district election administration authorities to compare their manual aggregation results with the electronic ones before releasing official results at their level. Copies were made of the results sheets from all polling stations at the district once the results sheets arrived from the polling centres and were given to the verification team to be introduced in the computer terminals. The software contains safety features to spotlight possible inconsistencies (e.g., comparing total registered voters with votes casts and votes obtained by individual candidates against total votes casts).

In theory, the system put in place before the 2013 elections had the potential to be highly useful, including by allowing higher-level electoral officials to verify the results at various stages. However, implementation was made difficult by various factors, both technological and human in nature.

The 2013 Jordan experience also underscores the potential for mistrust. Some stakeholders still believe, one year later, that some form of malpractice took place. Their suspicions stem from the publication of provisional results coming from different sources with different results and the change of results for one national constituency seat once all data were in the capital upon verification of IEC.

The Jordan experience shows that nobody should forget that with transparency comes accountability, and the procedures used have to be applied in a consistent and objective manner. The credit gained for releasing fast provisional results can easily backfire if the results are changed afterwards without proper explanations as to how the system operates being

2.2.4 Triggers

Election management authorities have a role in safeguarding the integrity of results, an effort that should both focus on ensuring that results forms are correctly filled in and instituting measures to prevent and detect fraud. One measure often incorporated in aggregation processes are 'triggers' that automatically prompt results being statistically assessed against pre-determined checks.

Frequently used triggers include more votes cast than registered voters; more votes cast than ballots issued; and an implausible share of votes cast for one candidates within the country context (e.g., 95 percent). In response to such triggers, checks can be undertaken to compare the results sections with the reconciliation data on the form. The particular checks to be run should be tailored to the political context and take into consideration that overly

restrictive triggers may not support correctness of the final results but can severely delay the tabulation process.

Severe delays may prompt authorities to abandon an RMS in the middle of aggregation.

Triggers are more easily and effectively responded to when ICTs are used, with action being taken after the data have been inputted. Responses to triggers can still be implemented in a manual process, but in such contexts they typically are conducted prior to the results being entered into the aggregation form.

2.2.5 Transmission and storage integrity measures

A part of the process that can be vulnerable to tampering is the movement of forms between locations. As such, when such transmission is done physically, it is usual for securitised materials to be used to prevent materials being tampered with. These can include tamper-evident envelopes, serial numbered seals with boxes and material transfer forms. At either end of a movement, materials transfer forms should be used to account for the materials.

If digital results are being stored or transmitted through networks that are not fully isolated, appropriate security should be implemented to ensure their integrity. Further, systems should be prepared for digital attacks. Where networks are isolated, measures should be enforced to secure the location and computers from external electronic devices.

2.2.6 Human factors and procedures

The human factor can jeopardize an entire exercise. Procedures should be clearly established to ensure homogeneous application by a variety of involved actors at different locations. Non-adherence to pre-determined procedures is a serious concern as it can both undermine RMS operations as well as credibility in the eyes of stakeholders. Adequate procedures manuals, training and supervision of staff are key to ensure that systems put in place can operate under adverse and stressful conditions. (Such conditions are normally the case during the implementation of an RMS in any country.)

2.2.7 Assessment and testing of an RMS

In general terms, based on the experience in Jordan in 2013, it is necessary to realistically assess what the technology applied means in terms of the amount of data, overall coverage of polling stations and time needed for releasing provisional results. This information has to be assessed through the use of test runs as close to reality as possible, including in regards to real-life geographical distribution and number of polling stations.

In many cases it may seem too expensive to undertake a full test run on the equipment weeks before the elections. At that point, therefore, partial test runs can take place, although at least one full test run should be done shortly before election day. That full test run can happen once sufficient infrastructure and staff are in place to allow a reasonable determination of the level of information that will be processed and analysed on election day and afterwards. Such information should be shared with other stakeholders to avoid unrealistic expectations immediately after elections.

Even partial test runs can help avoid potentially major problems during and following polling. If not managed automatically and explained properly, for example, minimal differences between candidates in plurality systems can create tensions if results are missing from some polling stations. The potential for accusations of malpractice can be limited if candidates and supporters are aware before election day of the fact that some polling stations will not be able to transmit results.

2.2.8 Levels for aggregation and publication of results

An RMS is partly defined by where results forms are transmitted and at which points the information is aggregated. For example, paper forms might be transmitted through multiple administrative locations until all are received at a central data entry centre, upon which they are aggregated. In another example, paper forms might be transmitted and aggregated at multiple locations, and then onwards transmitted and aggregated until full results are completed. Of course, the use of electronic voting machines may require no paper results forms at all, with the votes automatically transformed into digital.

Through the aggregation, the points where forms are chosen to be transmitted and aggregated often bear meaning, such as whether they are at electoral district or regional level. In elections such as presidential races or when a referendum is held, interim aggregation points of political importance may exist even when the results are largely determined by national totals. For example, a candidate may need to win a majority in a minimum number of constituencies, as in the Kenyan presidential election. Care must be taken to choose the right number and level of aggregation points for the particular country and election context.

Beyond the design of the underlying architecture – all paper, a hybrid paper/electronic system, a monolithic results database with suitable redundancy and availability or a distributed model – any RMS must deliver the results **where** and **when** they are needed. This is essential for reasons including the following: (1) to facilitate the work of returning officers and EMB officials who validate official results; (2) to meet the demand for timely results by stakeholders; and (3) ultimately to deliver final official results whose accuracy and integrity can be empirically demonstrated, thereby ensuring stakeholders' confidence in the outcomes.

Each configuration of aggregation – based on where aggregation takes place – has its own advantages and disadvantages, which vary depending upon particular country context. Differences can be seen among, and comparisons made regarding, the three broad configurations presented below.

1. Centralised tabulations, where forms are transmitted to and aggregated at a single national results centre. Such a process:

- better provides the central authority with the ability to strongly oversee and ensure consistency in the aggregation process;
- places the results centre in the locality of the persons responsible for procedures, thus making it easier to respond to unexpected behaviour of field staff (including fraud);
- requires the need to establish and manage a large results centre if the results are to be aggregated quickly. To establish a single location of sufficient size and to recruit sufficient staff can be challenging;
- can be complicated to run because often the complexity of managing a results centre grows with its size and the number of unique forms it is to aggregate;
- typically places the results centre far from other polling materials, thus slowing down the process of investigations to resolve issues with forms;
- can delay completion of the counting process. If transmission of forms is done manually, delivery times may affect the overall time for releasing results; and
- has inherent disadvantages associated with any centralised process. Observation of the tabulation can only take place in the single location, which may be complicated if there is distrust among regions.

2. Multi-level tabulation, where forms are transmitted to and aggregated at multiple sub-national results centres before being combined at one or more levels. In this process, each results centre is responsible for the aggregation of polling stations within the geographic area assigned to it. Transparency and accountability require multi-level tallies to be visible. Accordingly, any RMS must ensure that relevant information is verified and published. Figure 7 below gives an example of how such work might be carried out at district and province levels as well as at EMB headquarters. In regards to a multi-level tabulation process:

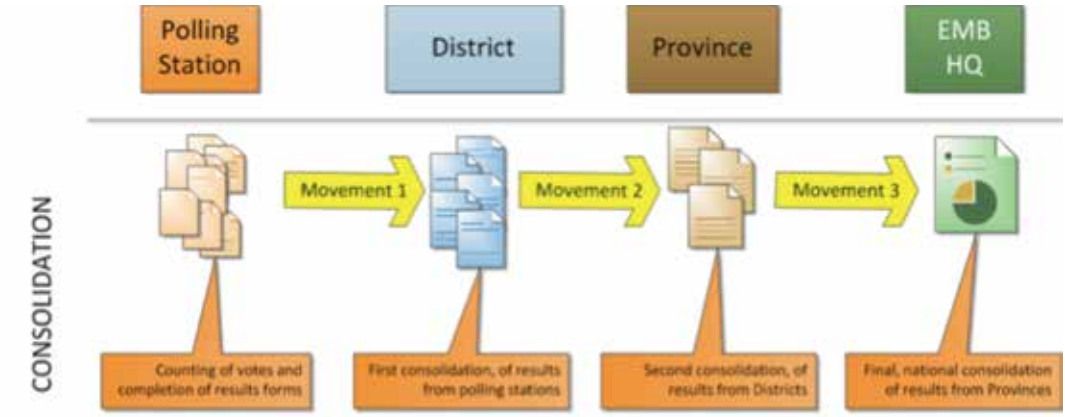
- each level can be locally observed;
- it may be faster than a single national tally centre, as delivery of most materials needs only be from the polling station to the level of first aggregation;
- smaller results centres are easier to establish in terms of finding staff and identifying smaller premises;
- centres are more ordered when they have fewer forms to process;

- it is more difficult to enforce uniform procedures across multiple locations;
- establishing technology across multiple locations can be more complex, costly and time-consuming to implement;
- results may be published at this level but later corrected at national level, causing confusion and potentially suspicion;
- changing procedures, if required, is more challenging; and
- with distributed databases (where the results from a single polling station may be transmitted to two or more servers) there exists the possibility that partial results may differ from level to level.

3. Polling station point of entry tabulation, where each polling station's results are digitised into database form at the polling station/centre. In regards to this process:

- results aggregation should be relatively rapid;
- establishing the information technology (IT) infrastructure may be highly challenging and costly, though it can vary depending on the approaches taken;
- training field staff can be more difficult, especially if the staff have limited or no computer literacy;
- the system and procedures must be established far in advance of polling in order to allow for sufficient testing to take place and for the training to be part of the typical polling staff training process;
- changing procedures, if required, is highly challenging; and
- the IT staff requirements are typically beyond those of in-house IT staff, especially if there is a need to establish a highly secure IT solution.

Figure 7. *Multi-level results management scenario*



MULTI-LEVEL TABULATION CASE STUDY: **KENYA**

Kenya implemented an RMS prior to the 2010 constitutional referendum that incorporates multi-level results provisions. The Independent Electoral and Boundaries Commission (IEBC) has since used that system for by-elections and, in 2013, for the country's presidential and general elections.

All official election results in Kenyan elections are based on paper results forms completed at polling station level and subsequent consolidation forms that tabulate polling station level data. An electronic RMS rolled out first in 2010 was intended to be used to deliver rapid and widespread availability of provisional results.

In March 2013, no fewer than six elections were held on the same day11 – for president, senator, governor, national parliamentary representative, women's representative, and county assembly representatives. Accordingly, there were multiple levels at which returning officers declared official results. These included county level, where county returning officers have responsibility for declaring winners of seats on county assemblies, and at constituency level, where constituency returning officers declare winners in parliamentary races. For the presidential election, the chairman of IEBC was the national returning officer charged with declaring the result of that nationwide race.

At each polling station, the results transmission system (RTS) used inexpensive internet-enabled mobile phones running a software application designed in-house. Presiding officers, once they had completed the results forms, were required to enter the results from these forms into the application. The RTS application then stored these results on the mobile phones and sent the information to three different servers – one each at constituency tally centre, relevant county tally centre and national tally centre. At each level, results for that level or race could be examined on a computer terminal by IEBC officials and projected for stakeholders and media present.

Within minutes of the receipt of provisional results at the national tally centre servers, the provisional results were made available via a customized application-programming interface (API) facilitated by Google to any stakeholders that had subscribed (at no cost). These included media houses, political parties, and domestic and international observers. IEBC's collaboration with Google also allowed graphic dissemination.

11 Policies have since been placed under review in light of the high turnout, long queues and problems with throughput and fatigue as six ballot boxes had to be opened and their contents counted.

As detailed in many observer and media reports, the RTS system only captured approximately 52 percent of presidential provisional results (though it did so with great accuracy). This failure had many causes, including inadequate testing and late and rushed procurement and deployment, but the highly ambitious multi-level architecture, requiring over 300 servers to receive provisional data from some 33,000 polling stations for six elections, undoubtedly added to the risks.

2.3 Involvement of stakeholders in RMS design

As with all other aspects of the electoral process, involvement of stakeholders in an adequate manner is crucial for the success of an RMS, regardless of which model is used. The involvement has to be weighted to (1) gain all possible positive inputs while (2) avoiding unnecessary negative consequences.

Too much involvement can be as bad as too little. Cases have occurred in which the involvement of stakeholders in designing an RMS either at too early in the process or at too high a level has left election administrators hostage to stakeholders' wishes, with resulting delays almost jeopardizing the implementation of the RMS. In some instances, for example, these delays helped prevent the implementation of a transparent procurement system or the ability to test the system and make necessary adjustments in a proper way[12].

On the other hand, if stakeholders are not involved at all in the design of an RMS they can rightly point to their unfamiliarity with the system. Such claims and concerns can increase suspicions as to the credibility of the system, and it is challenging to explain a system and obtain stakeholders' buy-in further down the road.

The stakeholders referred to here are mainly political parties and candidates, but may also include other state institutions (e.g., the judiciary), civil society (including observers), media and international partners (including observers). There are many possible ways to include them, such as (1) at established intervals to update them and gather feedback on the various stages of the RMS, or (2) to convene them when key issues have to be addressed and decisions need to be taken (e.g., in regards to transmission of data, hardware and software issues, and staffing).

12 The 2013 elections in Honduras offer a notable example of such challenges.

Importantly, citizens need to be made aware of the system through public information activities. The main goal is to ensure appropriate messages are sent as to what to anticipate to avoid unrealistic expectations that may create tensions in the hours and days following the closing of polls. Election administrators should always bear in mind that too much information too soon can be as bad as no information at all. An acceptable balance has to be found between keeping stakeholders informed of the progress in an RMS and ensuring that the quality of the information released is sufficient to avoid possible misunderstandings. Such misunderstandings can occur, for example, when provisional information differs too much from preliminary results. This balance varies depending upon the political environment; typically, where tensions are high any results released should be as accurate as possible.

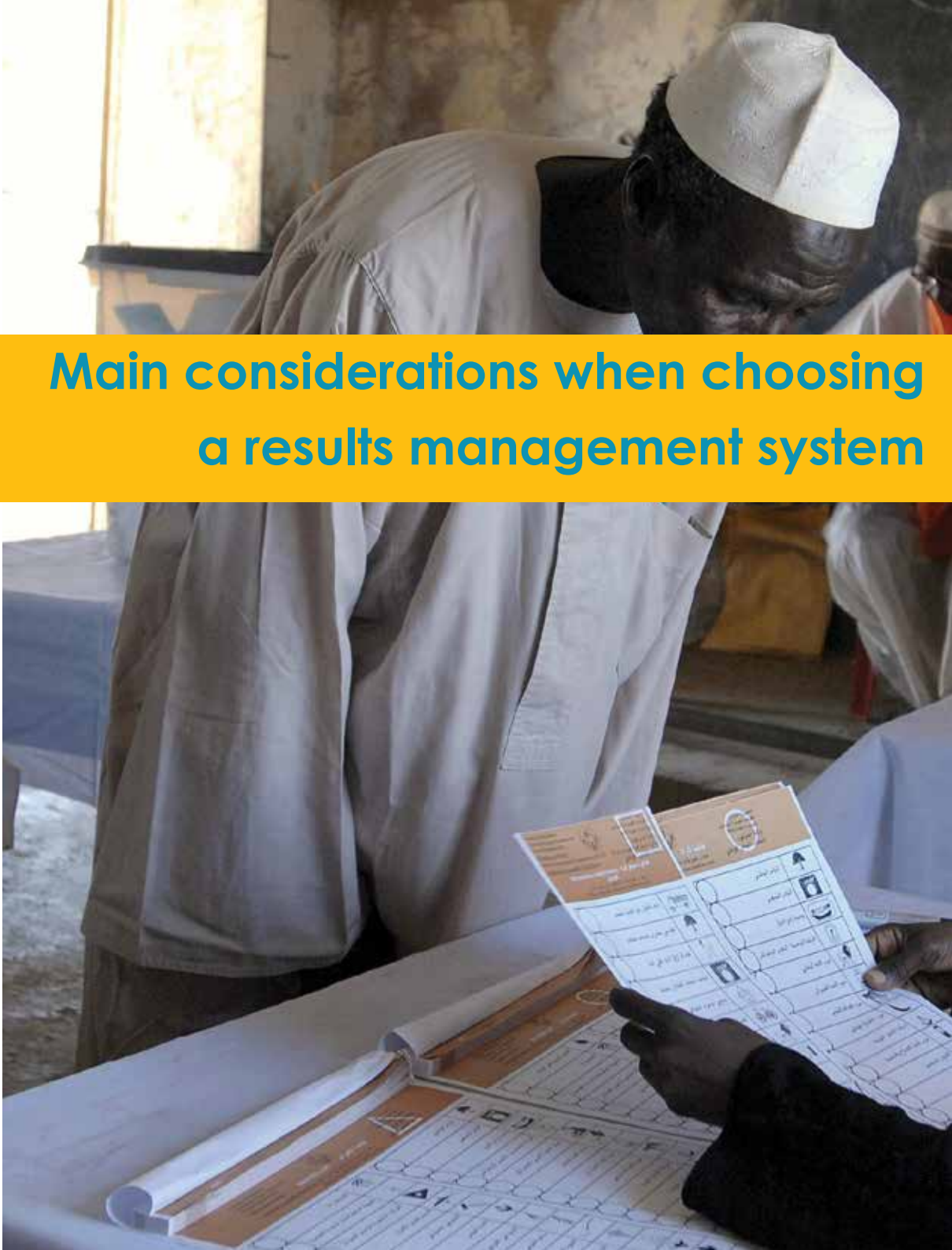
A best practice for any context is to establish coordination committees with political parties[13], civil society[14] and media[15] representatives well in advance of elections. The RMS can be a topic of discussion during these committees' meetings, thereby helping build mutual trust between these stakeholders' representatives and election officials.

13 Examples of such committees include political parties liaison committees, national political party forums and political parties consultative forums.

14 An example would be a civil society forum.

15 Examples of such committees might include national media forums and elections media forums.

Main considerations when choosing a results management system



Voting in National Elections Continues in Khartoum, Sudan
UN Photo/Tim McKulka

Before deciding on a results management system (RMS) model, an EMB should carefully consider various issues that should influence their decision. Some of the main issues are discussed below[16].

3.1 Political environment

Elections are first and foremost a political process, one largely defined by contests between individuals and parties. Often the results aggregation and announcement period is the most sensitive part of any such contests. It is, after all, the moment in which winners and losers are named, and the willingness for losers to accept their fates varies depending on context (including a nation's political history). Furthermore, trust in an EMB's integrity varies depending on the context – especially if it is viewed as aligned with one political grouping. This situation should be considered in decision making.

Any RMS established should be appropriate to the particular political context.. Post-conflict or transitional elections often require processes that are far more rigid than mature democracies. In these fragile environments, the stakes are perceived to be higher than in mature democracies as there is limited experience of losers who might have a chance of winning in the future. In addition, the level of trust is often lower and thus less capable of tolerating mistakes and corrections.

3.2 Legal provisions influencing an RMS option

It is preferable that legislation does not contain provisions that unnecessarily limit or otherwise constrain what RMS models an EMB can adopt. That said, in some contexts there are issues of significant importance which a parliament may feel compelled to affirm. Such issues may include, amongst others, the locations where results are tabulated and authorities responsible for tabulating and announcing results, the sequence of events, timelines, the challenges and appeals process, the details that must be published, provisions regarding audits, and the rights of observers and agents.

16 A check list to determine the current and possible future status can be found in Annex 2.

Sometimes, the legislation may unintentionally limit the options that an EMB can explore, especially given that many election laws pre-date modern RMS options. For example, the electoral law may stipulate that paper originals of the results protocols are provided to the higher-level election administration and political parties and candidates. In such a situation, many automated/high-tech RMS options cannot be utilised. In cases where the use of preferred RMS options is prohibited due to provisions of this sort in existing electoral laws, it may be prudent to adjust the law accordingly, taking into consideration that it may be a long and difficult process.

In other countries, where laws are silent on key issues, it may be useful to affirm the validity of the EMB's right to make the RMS decision it sees fit. Legal interpretation can be sought, and reviewed by stakeholders, to confirm compliance with relevant laws.

3.3 Cultural considerations

Elections are not merely about technicalities; they are sometimes entrenched in people's life and are occasions to be shared with the community. This includes also the process of aggregation of results. Thus an EMB should consider cultural issues and expectations when deciding on an RMS model.

For example, in some countries citizens and party agents wait for the count and aggregation of results so they can be part of a historical moment. Not allowing this experience or taking it away may render the whole electoral process less acceptable.

Countries, and communities within them, vary in their cultural attitudes and trust towards technology. Some hold a strong distrust or lack of understanding with regards to it, while in others its use can actually foster trust. Similarly in this regard, some cultures have a strong affinity to paper documents holding an intrinsic value even in the absence of their legally binding status. As such, fully electronic process may be discredited.

3.4 Transparency

As it is with all aspects of an electoral process, transparency is essential for the success of an RMS. Being technically perfect is not sufficient; in addition, stakeholders have to be convinced that an RMS is accurate in translating casted votes into seats for representatives. Therefore, all steps of an RMS should be transparent and allow interested actors to verify them. However, transparency has to be dealt with in a thoughtful and professional manner, as in some cases too much transparency can also negatively affect an RMS.

If, for example, raw data are being released without verifying their accuracy beforehand, stakeholders must be clearly informed in advance of such data's status. If that is not done, they could justifiably be surprised and suspect foul play if the results released later are different from the initially released ones. In more fragile environments, it may be considered too risky to release such information even with explanations and warnings.

Transparency is also relevant regarding access to the process, access to the results and access to the software. In terms of access to the process, political party agents, media and observers should be given access wherever possible. In results data entry centres these groups are typically given access during all operational periods, to all used spaces for entry and storage. Sometimes CCTV (closed-caption television) is also established. In some countries, access feeds to results data entry centre are streamed over the internet. As part of accessing the process, the rules governing the process should also be published well before the start of the aggregation in order for stakeholders to know what they should expect, where deviations from expected operations are, and to have the opportunity to train their observers/agents accordingly. Such rules should include regulations, concepts and all procedures.

In terms of access to results data, the most effective transparency occurs when results are accessible by polling station/centre. Such access is largely only possible with digitized results. A website may be created which displays the data, as per the last release, potentially also allowing information to be downloaded so that stakeholders are more able to use it. One example is the website created for the 2011 South Sudan referendum (http://southernsudan2011.com/).

In some cases, EMBs may also wish to give particular stakeholders more privileged access to information outside of public releases. However, this should be considered carefully as they encounter the issues previously stated with regards to what happens when raw results change. Processes are increasingly governed by software, with some aggregations relying on it entirely. As such, if software is thought to be sufficiently complex and it is believed that there may be questions regarding the tabulation, the code base may be made available for inspection. This was done in Libya for the aggregation software, which was made available on an online repository[17]. If a code base is made available, it should be shared sufficiently in advance of the aggregation for interested parties to have the chance to review the code, and for the EMB to be able to resolve critical issues if identified.

3.5 Credibility

An RMS not only has to be credible, but also appear to be so. It is therefore important that all elements of it are managed in a professional manner that mitigates suspicions of fraud. For this to happen, proper procedures have to be put in place and staff should be trained to implement and apply them consistently and without mistakes. In some cases a final decision on an RMS was made too late to allow for sufficient time to recruit and train all involved staff properly. The result in many such situations has been poor performance that weakened the credibility of the process.

17 See https://github.com/onaio/tally-ho.

3.6 Complaints adjudication systems

An RMS should accommodate the right of stakeholders to challenge results at various levels. Electoral dispute resolution (EDR) should be embedded within every RMS and provide sufficient possibilities for redress at the various stages of the system, and the inclusion of decisions into the results.

One important component may be the ability to complain to an EMB itself. Complaints are normally addressed to a higher-level EMB authority, which then must determine where and at which level to investigate (e.g., district, region, national). If the decision is not to the satisfaction of the complainant, a second level of redress has to be provided, usually involving the judicial system. At this stage, appeals and challenges are typically formalized and they are usually the last recourse for the complainant.

Actors potentially involved in a complaint adjudication system as complainant include political parties and candidates or their representatives, voters and sometimes citizens in general. Addressees are the EMB and, usually, the judiciary. In some contexts the judiciary elements involved are regular courts, while specialized electoral tribunals exist in others.

It is important that clear and specific timing for decisions on complaints and challenges are inserted into the overall RMS plan, and as appropriate within legislation. This is needed to make sure that no lapses occur that extent the release of final results over too long of a period of time (e.g., beyond the deadline specified in the electoral law).

3.7 Involvement and expectations of stakeholders

To increase the transparency and credibility of elections, the involvement of various stakeholders must be considered when selecting an RMS. As mentioned earlier, actors normally involved include the following:

- political parties and candidates. They must be able, for example, to monitor the aggregation of results at the various levels;
- civil society organizations. They are usually active in the area of voter education, to explain to citizens how an RMS works, and in monitoring by observing the implementation of an RMS;
- the media, because representatives from the sector help inform the electorate how and why an RMS works, thereby fostering transparency and credibility; and
- the judiciary, because (as stated earlier) it is involved in managing challenges to the RMS as well as other electoral disputes.

Finally, voters need to understand how an RMS works and feel confident that it translates their votes into seats allocated for candidates without any interference that may improperly

alter the results. It is extremely important to explain in advance how an RMS works and comply with those procedures throughout the process. If last minute changes occur without informing stakeholders, misunderstandings can occur and the process could be derailed.

3.8 Level and type of elections

The type of elections being implemented also influences an RMS option. The difficulty increases with additional layers of aggregation. If, for example, results need to be aggregated for presidential or national constituency assembly elections, the required steps may be more complicated than if they are only aggregated for local elections. Sometimes various elections take place simultaneously, thus increasing complexity as results are being finalized at various levels (e.g., municipal, regional, and national) and different EMB authorities are responsible for those levels.

3.9 Technology

As in many other aspects of the electoral process, the use of technology in results management systems has created the possibility for improvement by facilitating immensely the task of aggregating data and providing a growing range of options for EMBs to consider.

At the same, technology also had posed new challenges for EMBs. Institutional challenges include the challenge of recruiting and retaining staff with strong IT skills, difficulties in both in-house development or sub-contracting of IT projects, and the complexity of managing and deploying costly hardware, to name but a few.

Technological advancements have also added some additional challenges for stakeholders to verify that the process is being managed in a professional and impartial manner. New measures should be developed to ensure that all stakeholders accept the introduction of technology and adequate possibilities are provided to verify the aggregation of data.

3.10 Costs

One consideration that is often underestimated is the costs of an RMS within the overall cost of elections. With the introduction of ICTs in this area, costs have increased drastically. It is therefore necessary to evaluate the financial impact of an RMS on the overall elections budget before deciding on the specific model to be used in any country. Considering that the infrastructure may only be used for a specific component of the electoral process, strategies have to be developed to justify the financial burden that an RMS brings to the table. Such strategies might include (1) highlighting the added level of credibility engendered by an effective RMS and (2) developing ways in which the costs associated with an RMS can be beneficial to other aspects of the process or after the elections to other components, either

inside or outside the EMB. For example, equipment purchased could be used for other EMB purposes, or by state or non-state actors and agencies, etc.

3.11 Risks

The main risks involved with implementing any RMS are related to (1) a late decision on the model to use, (2) insufficient transparency as to how the RMS is going to operate, and (3) poor or deficient implementation of the RMS. In order to avoid or reduce the possible negative impact of these risks, it is necessary to (1) agree with stakeholders, after thorough discussions and far in advance of actual implementation, as to the advantages and disadvantages of the various models being considered; (2) design standard operating procedures for the implementation of the RMS; (3) undertake a public information campaign to explain how the RMS is to function; (4) early on, secure sufficient funds needed to implement the RMS; (5) recruit and train all staff involved in the RMS in a timely and professional manner; (6) procure all equipment in due time; and (7) implement the RMS according to the agreed upon model and procedures, keeping stakeholders informed as to the implementation process.

3.12 Infrastructure

Adequate infrastructure is required for any RMS to be put in place. Depending on the model used, more or less technology will be needed. Even with a manual model, some equipment and forms, communications means and locations need to be procured and secured to be able to implement an RMS properly. Underestimating the need to secure proper infrastructure has in some cases been the main cause of failure of an overall RMS. The likelihood of implementation challenges and failure is greatly increased if, for example, (1) not enough or sufficient space has been allocated for the various levels of aggregation at communal, district, departmental and national level; (2) not enough or inadequate communications means have been secured to enable results to be transmitted from one level to the next; or (3) no provisions are in place to allow stakeholders to follow the aggregation process, thereby damaging the credibility of the process by creating doubts as to the accuracy of the results.

3.13 Physical security

Security is key to the success of an RMS. The degree of security needed may depend on the specific situation in a country; regardless of the context, a security threat assessment is necessary to determine the sort of security mechanism that can help ensure that an RMS is implemented without disturbances. Coordination between an EMB and security agencies therefore is essential from an early stage. Security agencies should be involved during the design and implementation of an RMS to ensure that the relevant security provisions are included and prove effective.

3.14 Sustainability

As with all major electoral operations, an RMS should take into account sustainability from the beginning. Some have argued that an RMS, like some other electoral process components, can be simplified over time as trust among stakeholders increases and therefore less need seems to exist for many confidence-building features. However, experience indicates that it is extremely difficult to deviate from already established parameters for electoral operations because, as some observers note, doing so jeopardizes what are perceived as international 'electoral standards'.

In general, though, it is evident that from the very beginning it makes sense to take into account potential changes to an RMS, which might be due to changes in election type, the political environment, changes in the law or demands for faster results. Such issues are important to consider when making decisions about an RMS to be used, so that if changes need to be made, the established system can be altered or built upon instead of discarded. One issue that needs to be considered is whether the EMB has ownership over the code base in order to make changes as required, or if instead there are ongoing costs assigned. Thus it is highly advisable to decide on an RMS that a specific country is likely to be able to utilize over the long term. Also essential to keep in mind are the realistic domestic financial resources. Dependence on donors should be limited to a minimum if an RMS is to operate over a longer term and not have to be scaled back in the near future due to financial or human resource constraints.

3.15 EMB capacity

A capacity assessment of the EMB should take place at the start of the design of an RMS. Such an assessment is needed to evaluate the EMB's ability to manage the various RMS models or to design one with existing capacities. One model may need more human resources, while another may require more financial and logistical resources. Without a proper capacity assessment of the EMB, an unrealistic RMS could be decided upon by the EMB in discussions with stakeholders. If that happens, implementation could fail and damage the credibility of the electoral process as a whole.

3.16 Timing

In line with the previous considerations, it is necessary to embark on discussions on which RMS to use at an early stage of electoral preparations. A period for planning (to include a concept of operations, timeline, and budget) is necessary for all RMS types and options.

The time required to establish an RMS greatly depends on the country context and the model chosen. A general guideline is that a simple manual RMS can be implemented in as little as six months. If technology is introduced or included, a further nine to twelve months are usually advisable. Any fully automated system typically requires 18 to 24 months to be properly implemented.

From the beginning, an operational plan[18] stating the various activities to be undertaken should be in place with specifications as to required human, material and financial resources to properly implement the selected RMS. Last minute changes should be avoided for the sake of credibility as well as to ensure the consistency of the operations. If such changes are imperative to guarantee the success of the elections, they should only be made with the agreement of involved stakeholders.

18 Annex 3 contains a manual model operational plan.

Main models of results management systems

FBallot Count Begins in Southern Sudan
UN Photo/Tim McKulka

The implementation of a results management system (RMS) is a complex operation that requires proper preparation and dedication by an EMB to be successful. As discussed earlier, a successful RMS can greatly bolster the credibility of the overall electoral process; conversely, the failure of an RMS can severely damage credibility and may jeopardize all efforts invested in previous phases. Therefore, sufficient attention should be given to establishing an RMS that sets the final stage, together with electoral dispute resolution, for a credible election process.

Regardless of the model used, an RMS requires substantial financial, human and material resources. The amount and type of resources depends on the model chosen. For an RMS as well as all other components of the electoral process, it is advisable to introduce ICTs at a slow pace via pilot projects. That approach provides opportunities to test the performance of the model and obtain stakeholders' reactions, both of which may be useful when adjusting the new model based on lessons learnt in order to establish a more robust and credible model over time.

4.1 Model typology

Any RMS has three broad strands:

- aggregation – how and where the results are added together;
- verification – how the results checked to ensure their accuracy; and
- publication – how results are communicated to external stakeholders.

Data transmission is a key element across all strands.

Components of an RMS can largely be categorised by their incorporation of technology to provide three models:

- manual systems include paper, calculators and spreadsheets;
- hybrid systems include both manual and automated elements. Automated parts may include those related to data aggregation, transmission or creation of a database, among others; and
- fully automated systems aggregate, verify and transmit results without human interaction.

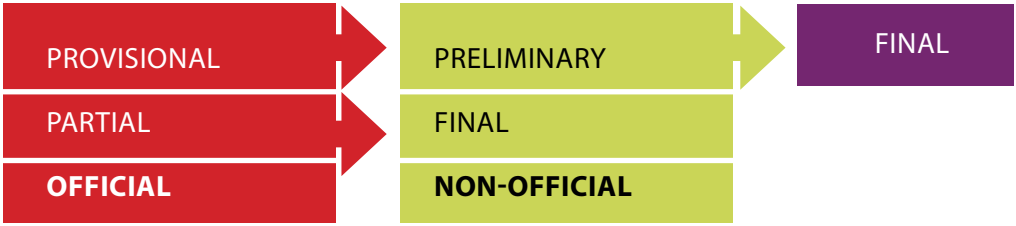
Table 1 provides a schematic illustration of the type of components within the three main RMS models: fully manual, fully automated and hybrid (both manual and automated elements).

Table 1. *Main RMS models*

Manual (M)		Hybrid (H)		Automated (A)	
AGGREGATION	**M**	AGGREGATION	**M or A**	AGGREGATION	**A**
TRANSMISSION	**M**	TRANSMISSION	**M or A**	TRANSMISSION	**A**
VERIFICATION	**M**	VERIFICATION	**M or A**	VERIFICATION	**A**

Although notable differences exist among the three main models, there is a fine line between an advanced manual model using computers and a rudimentary hybrid model. The same is the case between an advanced hybrid model using databases and transmitting data to servers and a non-fully automated model. In order for this publication not to be too cumbersome, which might be the case if all possible options are explained, rough definitions are used when discussing the various models.

Figure 8. *Different categories of results*



Also of note regarding an RMS is that different levels of results centres can be established. Factors influencing decisions and needs include the political context, administrative division(s), the nature of the elections being held, the number of polling stations and polling centres, security concerns, financial issues and available infrastructure. The level of trust as well as the capacity of the elections management body are also important factors. Table 2 provides a schematic illustration of options for establishing results centres.

Table 2. *Options for results centre levels*

To From	Result centre 1	Result centre 2	Result centre 3	Result centre 4
POLLING STATION	Municipality	District	Province*	National
POLLING STATION	District	Province	National	
POLLING STATION	Province	National		
POLLING STATION	National			

* Depending on the specific administrative division, this may also be the state or the region

4.2 Overarching considerations for models

4.2.1 Political and social context

A chosen model must be appropriate for the country's current point of political development, the level of tensions (if any) over the forthcoming election, the trust in the EMB and the trust in the use of technology. An inappropriate model can result in increased tensions, and potentially fuel a rejection of results or even electoral violence.

4.2.2 Administrative division

In smaller countries, or where security, trust or oversight requirements predominate (such as in transitional or post-conflict nations), it is often decided to have only one level of results consolidation – at the national level.

If a multi-level approach to aggregation is taken, then decisions need to be taken as to how many levels should be established and how aggregation will be conducted at each level. Depending on the size of the electoral constituency for which elections are being held and its relation to existing administrative divisions, it may be advisable to have a first level of the results centres at local level. This would normally be at municipal level if an automated RMS model is not being used.

The use of a municipal level results centre is recommended if at this level there are some pre-existing conditions that can facilitate the creation of such a centre. Such conditions might include physical infrastructure (e.g., schools, health centres, storage facilities, roads, and communications equipment) and human resources (people who can be trained to operate a results centre). Having pre-existing conditions such as these in place can reduce the amount of results that are gathered at the next results centre level, thereby helping lessen the likelihood of bottlenecks that impede the fluid management of results in a timely fashion.

In cases where such pre-conditions do not exist and the work involved in creating them would be substantial, consideration should be given to how to transport the results from the polling stations to a higher level where pre-conditions exist. To avoid chaos and backlogs, proper planning is needed to manage the dispatch and arrival of results forms at higher-level centres. This can be done by, for example, creating various sub-units at the recipient results centre to manage the results arriving from different stations.

4.2.3 Nature of the elections

In some cases, security and oversight issues may deem it advisable to concentrate results management at national level. However, in many cases these are not concerns and the best approach might be to, where possible, have each level of results centres mirror the constituency of representatives to be elected. Thus, for example, one results centre level, normally the first, should be at municipal level when elections are being held for municipal representatives.

This approach serves two important purposes. For one, it allows citizens to be closer to the aggregation process. And secondly, results announced at constituency-specific levels can, if accurate and not subject to significant change, relieve pressure on results announcements at the national level, thereby helping reduce tension and the potential for conflict throughout the various levels of results aggregation.

In addition to the municipal level (if relevant), the following levels of results centres could be established:

- district level, if representatives from this constituency are being elected (e.g., for district councils);
- state/region/province, if representatives are being elected for bodies such as state parliaments or if representatives in the national parliament are elected at this constituency; and
- national level, either to consolidate results from the whole country if presidential elections are being held or if elections take place which require a national constituency – e.g., to a national parliament or to validate the results from a lower-level election (such as for a municipal council).

4.2.4 Security concerns

If security is a major issue during results aggregation, the number of results centres should be as few as possible to allow for the best possible security to be put in place at all centres. Security has different dimensions. Other than the obvious physical security of the buildings and communication structure, it is also important to plan for and implement mechanisms and structures to safeguard the security of voters and staff at results centres.

Also, if there are concerns that security personnel may attempt to interfere with the process, having fewer results centres may limit such a possibility because there would be more observers and participants at each centre.

Digital security is increasingly a concern. A threat assessment could be conducted; it could consider the range of threats to infrastructure, software, procedures and data. Threats may be internal, domestic or even, theoretically, international.

4.2.5 Financial issues

If funding is an issue, a feasibility study may be needed to compare the funds required to implement various RMS models. The feasibility study should first consider the direct costs of potential models followed by funding needed for decentralization of an RMS. Decentralization in this context refers to the number of levels assessed as optimal to balance the different criteria needed to make an RMS successful. The most important criteria are accuracy, timeliness and transparency.

4.2.6 Available infrastructure

An assessment of the existing infrastructure has to take place to decide which RMS is best suited under the existing circumstances, or which steps have to be taken to set up the

necessary infrastructure to implement the desired system. Time and funds available play a major role in this regard. If there is no guarantee or likelihood that sufficient time and funds will be available, priority in decision-making should focus on avoiding complications and complexity. Thus, for example, an RMS that can be set up under existing pre-conditions is an advisable option.

4.2.7 Number of polling stations and polling centres

The amount of data to be aggregated is an important element to consider when deciding how many levels to establish for results centres. In particular, too many polling station results may be unmanageable for too few results centres. A proper evaluation thus has to be done of the number of polling stations assigned per results centre in order to ensure smooth aggregation, transmission and announcement of results. A balance has to be sought between creating numerous results centres to reduce the pressure on each one and not establishing a number that is unfeasible in terms of financing, human resources (e.g., qualified staff), security concerns or adequate infrastructure. A reliable rule of thumb is to identify the minimum number necessary to achieve quality results.

Stakeholders should be consulted as early as possible in the planning of the results management system to avoid complications and misunderstandings further down the line when time is crucial and the election process could be jeopardized.

4.2.8 Planning

Whatever RMS model is used, the planning process is generally the same. Ideally, an operational plan exists that incorporates all relevant issues related to the implementation of the electoral process, including results management.

The master plan should be drafted by the EMB and ideally presented later to stakeholders for their feedback, which is an important part of the process of getting them to buy into the plan. While more time may be needed for this inclusive approach, the rewards in terms of credibility far outweigh any negatives associated with time spent in discussing the plan and adjusting it.

The following are various steps included in planning the implementation of an RMS. They are listed in ideal sequential order, from first step to final step.:

1. design a concept note on RMS, including timeline and budget;
2. establish procedures to be followed when executing the RMS;
3. identify locations for the results centres at various levels;
4. identify, recruit and train staff who are going to work on the RMS;
5. identify and procure necessary equipment for the RMS, including third-party services (e.g., software development, IT operations support) and equipment for the results centres (e.g., lanterns, communications materials, furniture) and for the aggregation (e.g., calculators, hardware and software, stationery, whiteboards);
6. ensure funding is available to pay staff in a timely manner. This is critical because the non-payment or delayed payment of staff has been the reason in various occasions for a delay in releasing results. It is imperative that funds are ready to pay staff according to contractual agreements, and that all involved understand these agreements; and
7. run a test or 'dry' run at least once with as realistic conditions as possible. This should be done sufficiently in advance of polling day to allow time for the implementation of possible changes in response to issues and concerns detected during the test run.

   Once all equipment and trained staff are in place, it is advisable to test how well the system operates under a realistic environment. In many cases a complete test run (real number of results to be received, aggregated and transmitted from all polling stations) is not done due to time constraints. Subsequently, ad hoc decisions are taken during the results management process when unexpected situations arise – such as a bigger delay than expected in aggregation of results, difficulties with transportation of results to next level, and difficulties with communication/transmission equipment.

If computers are to be used to support the aggregation or verification phases, it is a good idea to introduce them at a first stage in a pilot project targeting a reduced number of results in parallel to using the system used previously. This approach allows for testing under real conditions the performance of the equipment and processes; moreover, stakeholders have the opportunity to understand the system and its technology. Depending on the outcome (value versus money), computers can be introduced countrywide for the next elections.

The parallel piloting approach helps ensure that mistakes and problems found can be addressed before the national roll-out. By-elections are also good opportunities to test new technologies or processes included in results management systems.

4.2.9 Publication

With any and all RMS models used, it is always necessary to publish results at the various results centre levels. Publication at this stage is essential to inform the public in general and

stakeholders of the results at those levels, thereby helping to increase the transparency of the process and augment its credibility. Notable publication stages include the following:

- Polling station. Results for each specific polling station should be posted for the public to see, and copies may be provided to political parties and candidate representatives to further enhance the transparency of the process. If possible, observers should also be able to get copies of the results.
- Results centre level. At every results centre level (i.e., municipal, district, regional and national), the results of aggregating either polling stations or aggregated results at the next levels should be posted for public view. As stated previously, to increase the transparency of the process copies may be provided to political parties and candidates representatives and, if possible, be made available for observers. Ideally, sheets or whiteboards indicating the individual results aggregated and the final results should be displayed for further transparency.
- In parallel to the two publication processes summarized above, provisional results may be made available via the internet, ideally through the EMB's website. If possible, such results also may be made available to political parties, candidates and observers.

4.3 Manual/low-tech model

The discussion and explanations below are based on the assumption that counting takes place at polling station level and aggregation at multiple levels. The specifics of an EMB's capacity, political context, type of elections and geographical and demographic conditions (among others) determine the number of levels that should be pursued.

Also of note is that the discussion below provides an overview of structures and processes in a typical manual model: the aggregation of paper polling station forms onto paper aggregation forms, and then onto paper results forms.

With manual/low-tech models, there are limited significant variations to the process when compared with hybrid models. Among the key main variations might be the use of Excel sheets either in place of the paper aggregate sheets or in parallel with them.

At a procedural level, there are many minor variations on models, as per the different contexts, environments and process designers' opinions.

4.3.1 Aggregation

Results management systems start once votes have been counted and the first results exist. This takes place normally at polling station level[19], where results sheets/forms are filled in with the outcomes for the specific polling station. As the aggregation under this model takes place in a manual way, typically the count also takes place manually.

Results centres will have been established to receive all results from polling stations in the specified area, and staff, equipment and procedures should be in place at those centres for the professional management of the results.

Once individual results sheets have been completed by polling staff, they are transmitted to the next higher level. In a manual process, transmission between levels typically occurs using tamper-proof bags by road or in some cases by sea or air[20].

A copy of the local results is usually posted at each polling station to allow citizens to be aware of the results at individual stations. In some cases, copies are provided to party representatives or candidate agents in order to increase transparency of the results at this level[21].

The head of the polling station sometimes informs the relevant authorities about the outcome for the different candidates and total number of votes. The information is usually conveyed by phone, either through voice or data transmission using applications. Results communicated in this fashion are particularly susceptible to error or incompleteness.

First level of aggregation

The materials are transported from the polling centre directly to the results centre, or through an intermediate logistics hub. In the case of manual tabulation, for most countries there are too many stations to feasibly do a centralised nationwide results centre. As such, it is expected that there levels of aggregation are established.

If the first level of aggregation is geographically small, then the head of each polling station, in some cases together with other polling staff and/or party agents, may deliver the materials personally to the relevant results centre or logistics hub. Materials should contain the original results sheets, together with the other materials stipulated in the procedures.

19 In a few cases results are aggregated the first time around from all polling stations inside a polling centre; therefore, the number of individual results sheets to be aggregated is smaller.

20 Depending on the specific conditions of a given country, especially security and infrastructure, the type of transportation means can vary considerably.

21 In some cases copies are also provided to observers. In other cases, though, no copies are provided and these stakeholders have to take note of the results by their own means, with no official document in their hands that can be used as proof of the results.

Aggregation of results in a results centre generally involves two key stages. These activities can be conducted by two teams (a reception team and an aggregation team), or combined under one. The stages are as follows:

- first, an initial review of the polling station results forms is conducted to verify that they are correctly completed and that they do not violate any integrity measures; and
- second, the information from the polling station results forms is transcribed onto the aggregation forms and the results are added.

With a purely manual process, it is important to keep the sequence correct in order to try to only allow correct and verified information to be written on the aggregation forms.
Ideally (and where possible), the head of the polling station should be present through the process to help address any inconsistencies or discrepancies. If the inconsistencies cannot be solved immediately, the results are put in quarantine for further consideration (which is done at the special cases unit).

Aggregation form completion

Once results from polling stations have been verified, the individual results from each polling station are introduced in the aggregation forms. These forms should contain the results from the various polling stations being covered by the results centre. Of course, each form can only contain results for a unique electoral district.

Calculators or computers are used to aggregate results and provide preliminary information for the EMB. Once all results from the polling stations covered by the aggregation forms are entered, the aggregates may be copied to the final results centre form. This form contains information on all votes obtained for the various candidates/parties and other relevant information (e.g., total invalid votes, total registered voters, and total unused ballots).

A copy of the results is usually displayed at the respective results centre or election office. Copies are typically provided to party representatives or candidate agents to increase transparency of the results at this level. (Such representatives and agents also should have been given access to all the previous stages, as discussed previously.)

Special cases

Special cases may refer to two different types of forms. One type has inconsistencies in the results. The other refers to forms for which complaints have been filed – in the case that polling station/centre complaints are accepted. A unit, or units, should be established to handle such cases. The types of staff to be assigned depend upon the procedures and regulations. For example, in some cases only legal staff may deal with complaints, while operations staff may be allowed to deal with inconsistency issues.

1. Inconsistency in polling station result records

The results sheets from polling stations that are evaluated as having inconsistencies[22] should be reviewed by a special team using previously determined procedures. This standardized process aims to ensure that no individual candidate or party benefits improperly from decisions.

Members of special case units responsible for reviewing inconsistencies should be appointed by the EMB and trained prior to the election. Procedures should be designed that determine how cases are handled and the powers ascribed to different actors. Depending on the legal framework, cases may be resolved though correcting obvious calculation and form errors, retrieving copies of the forms and audits or recounts of the polling materials. If none of these options resolves the inconsistencies, a decision must be taken as to how to solve the problem, which may include keeping the disputed results in quarantine until all preliminary results are known. Unresolved cases may be closed if the number of votes in the specific polling station(s) affected by inconsistencies would not change the final outcome[23]. If the total number of votes could change the results, legal provisions should guide the following steps to be taken. Actors subsequently involved would likely be the EMB, the judiciary or both. One potential decision would be to repeat the elections in the specific polling station(s).

2. Complaints

A special cases unit may also manage complaints filed at a polling station regarding specific results and decide if there are grounds for the complaints. If the unit finds a complaint has merit, the standardized review process should begin and the results may be revised accordingly24. If the unit decides not to respond to the complaint, the complainant should be informed about options to challenge the decision before relevant courts.

Electoral district results

When elections are held for sub-national electoral districts, announcements by the relevant field/district office or returning officer may serve as the official preliminary declaration of results for those elections. In other cases, the law may require that the national EMB be the only authority that can declare preliminary results.

22 Such inconsistencies might include: (1) the total of valid votes do not equal the total votes obtained by each candidate; and (2) the total number of ballot papers received does not equal the total of valid and invalid votes, spoiled and remaining ballots.

23 For example, if the number of contested ballots is 50 and the difference between the candidate with the most votes and the second-place finisher is greater than 50.

24 This also known as administrative electoral dispute resolution. However, it does not happen always based on prevailing legislation.

At the end of the first level of aggregation, all applicable polling station result forms should have been transcribed within aggregation forms, and consequently within results centre forms. In many cases, these results centre forms contain the preliminary results for a particular electoral district. However, if a results centre does not span all the polling stations in a particular electoral district, then the aggregation and results centre forms completed within do not contain the necessary information required to declare preliminary results. That is most certainly the case for national elections with single district, but may also be the case for large districts. In such cases further aggregation is required.

The transmission process of results documents between EMB offices typically requires the package of documents to be forwarded in tamper-proof bags or envelopes. This transmission may include related forms completed in results offices to inform higher electoral authorities about the results and total number of votes. In addition to the results, possible complaints gathered during the aggregation of results may be transmitted to the next level for consideration and decision.

Additional levels of aggregation

Where further aggregation is needed at a higher level, similar procedures as described for the first level can be applied.

The outcome of the additional aggregation should then be transported to the national results centre.

National results centre

In any election, a national results centre must be established to receive results from decentralized EMB bodies. If no elections have taken place which require a aggregation of results at national level (e.g., presidential elections, national level constituency for parliamentary elections, national referendum), the tasks of the national results centre are limited to (1) verifying that the results aggregation of the lower levels has been done accurately and (2) compiling data for electronic publications such as on the official website.

When elections are held that require aggregation at national level, the results coming from lower levels – state, regional or provincial – are processed in the same way they have been processed in the various results centres at the lower levels. As at the lower levels, there should be reception, aggregation and special cases units at the national level.

In some cases the results forms are forwarded to the higher levels (regional and national) in the company of ballots and materials used. Sufficient storage space must be secured for all of these items and they should be organized and classified to facilitate easy access by the EMB. Proper and efficient storage is especially important if complaints need to be managed.

Once all results are received from the various lower-level results centres, preliminary results are released by the EMB regarding all elections. Final results are announced after decisions have been taken regarding any complaints and challenges. Depending on the legal provisions, ballots and forms are kept for a specified period of time or can be destroyed.

4.3.2 Verification

Verification refers to the process by which an EMB ensures the aggregation is correct.

Before polling station forms are entered into the aggregation forms, verifications are conducted. Issues that could be verified at this stage include the following:

- consistency among the number of registered voters, ballots and total votes;
- consistency between individual results by party/candidate and overall total of votes; and
- that required signatures of polling staff (and, if required, of party agents) are present. Similarly, it is necessary to ensure that any relevant stamps, seals, etc. are in order.

To check that the initial aggregation is correct, the EMB may use a combination of original source documents, data sent electronically or by voice (if they are considered relatively reliable) or sufficiently detailed interim aggregations, depending on the location of the verification process. By using these secondary data sets, numbers can be checked and discrepancies identified.

It is also possible to run two manual aggregations in parallel in the same results centre, conducted by different teams. In such a process, each results centre creates two versions of each aggregation form. The forms are then compared and discrepancies are identified, resolved and one authoritative set of forms is created. This verification process can be done either with both teams working on paper, or with one or both entering data into a prepared spreadsheet on a computer.

To facilitate verification at a higher level (e.g., regional), copies of the polling station results can be transported/transmitted (for example, by using facsimiles). Officials at the higher level can then enter the results into their own aggregation sheets and compare the results emanating from this aggregation. If the results are the same, no further action is required. However, should the results differ, an investigation must take place to find out the reasons for the difference and come up with acceptable preliminary results.

Another option is to send a copy of all results to the national level and aggregate them at that level for each district, and then compare the results afterwards. Decisions as to the adequate level for verification (other than aggregation unit level) depend on resources and infrastructure available at the various levels of results centres. To do this at a national level may be unwieldy and slow, however.

It is also possible to use copies of the polling station results forms, and conduct a sample review of the aggregation forms to assess the scope for errors. This would be relatively simple at all levels.

Another verification procedure is to maximise transparency in the process. During the aggregation phases, allowing in party agents and observers to observe aggregation can allow them to provide immediate feedback if mistakes have been (or appear to have been) made. In some cases, an overhead projector or projector may be used to help display the form to persons monitoring the aggregation. Agents and observers can be requested to sign all results-related forms, as they have been requested to sign polling station results forms.

4.3.3 Stakeholders

Political parties and candidates – and also observer groups in some cases and contexts – typically review results as part of their activities. This can be done in the form of parallel vote tabulation (PVT) exercises. In an ideal scenario, this consists of the party representatives or other stakeholder gathering all results from polling stations and comparing their outcome with the official results released by the EMB[25]. It is best practice for an EMB to facilitate the work of stakeholders by assigning spaces inside results centres, at all levels, to allow stakeholders to have access to the process and verify first-hand that operations are proceeding properly. Further, it is valuable to post polling station level disaggregations so political groups and observers can review this against their PVT-collected data. In some cases, computers with 'view-only' and print capabilities may be made accessible to enable stakeholders to access and view the station-level aggregations.

4.3.4 Publication

Paper copies of the results

Paper copies of results are normally released in the form of printouts and posted at polling stations and results centres for the different elections held. The copies are released after the totality of votes or results sheets have been treated at the specific level.

Raw data versus treated data

The first set of information (raw data) is provided to representatives of parties, candidates and observers at a polling station once the total votes for that polling station have been counted.

In some cases, the head of the polling station may transmit the results via telephone to a

25 Another possibility would be sharing individual results among parties to obtain a complete picture if no party is able to be present at all polling stations.

higher level. However, they should be considered for release only in cases where (1) there is a high degree of confidence in the accuracy and integrity these figures, and (2) the political environment is characterized by a high degree of trust.

Meanwhile, the original results sheets are transported to the higher level for aggregation and treatment. At that level, election administration officials can make decisions regarding received complaints and efforts can be made to detect and address possible inconsistencies. Such treatment often alters the results of some polling stations, which means there are discrepancies with the provisional results released in press conferences at a media centre. (Those results may contain consolidated data received from various polling stations via telephone.) There are significant risks if the provisional results vary significantly from the preliminary ones; as a result, such an approach is usually reserved for mature democracies. Regardless of the age or solidity of the democracy, it is vital for the EMB to stress that such results are provisional, and that any extrapolation from partial results to final (national) results is unwise. For this to be possible the EMB has to be in possession of sufficient data – and from different areas of the country – to be sure that the first picture obtained based on first results released is not significantly different from more 'solid' results released later (including final ones).

Many cases are known where EMBs decided to release results very early in response to pressure from stakeholders, only to realize that the next set of results changed the first results dramatically because, for example, the newer set came from different regions. In such instances, losing parties often claim fraud.

If a website has been created by the EMB to release results, it should be tested properly before polling day to be sure that it can accommodate the maximum expected number of visits and not break down. A malfunctioning or 'crashed' website could be a trigger for possible allegations of foul play.

4.3.5 Requirements

Concept, timeline, budget

One of the first steps towards designing a RMS consists of drafting a concept note, which should include a timeline and tentative budget. The concept note should include general explanations about the RMS, potential partners, specific activities envisaged and anticipated challenges to implement it.

While it is important for all stakeholders to be on-board in the design of the RMS, the drafting of the concept note should be an internal EMB activity. The concept note can be shared with stakeholders for comments further down the line. The process could be delayed unnecessarily at this early stage if the involvement of stakeholders happens too soon.

Realistic timelines and budgets should be provided to allow the EMB to take a careful, fully informed decision on a proposed RMS.".

Legal requirements

Existing legal provisions frame the work an EMB can undertake while designing an RMS. In some cases legal provisions may be silent in regards to results management, thereby allowing an EMB complete liberty to design whatever RMS it deems appropriate. In other contexts or environments, however, existing legal provisions may apply, such as requirements regarding the level of results aggregation, the transmission of paper copies or the provision of information to specific bodies, etc. These restrictions must be considered by an EMB and legal counsel should probably be sought if the desired design might conflict with possible interpretations of legal provisions. The next steps can be considered and undertaken only after the legal framework is clear and no doubts exist as to their impact on the design of an RMS.

Drafting procedures

Usually an evaluation has been conducted of the RMS that was last used; lessons learnt from that exercise can feed into the design of a new RMS. Procedures should be drafted covering all aspects related to a new system, including the various levels of results aggregation, verification and publication. These procedures serve as the basis for discussions with stakeholders and preparation of training manuals for staff involved in implementation.

Premises

Premises (physical space) need to be secured for the various levels of results centres. Sufficient space should be allocated inside each centre for the reception, aggregation and special cases units as well as the work of district-, regional- or national-level electoral officials. As soon as possible, the following should be designed and distributed: flow charts for information and transmission of paper copies, organograms for the staff assigned to each unit, and drawings with space allocation inside each centre. Space is also needed to store materials accompanying the results – e.g., bags with ballots and other equipment used during the polling. Special space has to be secured for ballots being put in quarantine. And finally, provisions should be made in advance for space for stakeholders to be able to follow the process.

Equipment, materials and forms

The equipment, materials and forms necessary to implement the various phases of an RMS should to be identified early on to enable timely design and procurement and testing or use of equipment, materials and forms in training sessions.

In a manual process, materials and equipment are typically basic, including forms, tamper-evident bags, and calculators. In some cases computers and printers are used to introduce results in spreadsheets and print them out. That process may be done either for aggregation or verification, or for both purposes. However, it can also be the case that projectors and other equipment may need to be procured.

A range of different forms is needed for an RMS to work efficiently at various levels and for the various units involved each time. These forms should be prepared far enough in advance to allow their use during the training of staff at the various levels and units. To help ensure processes move smoothly, those individuals need to familiarize themselves with relevant forms before using them during a real electoral event. Also, staff may discover some glitches or mistakes when using them in practical training exercises; time therefore has to be available to redraft the forms if needed and print them before polling day.

As always, spare equipment, materials and forms should be on hand to be dispatched if needed to centres requesting additional items due to unforeseen circumstances. Normally, at least 15 percent extra stock should be available.

Design of forms and identification and procurement of equipment and materials should be done early on to allow their use during training and test runs by staff assigned to work on an RMS.

Communications

The first level of communication is from polling station to headquarters in order for heads of stations to transmit provisional results. This communication can be undertaken in various ways, but most commonly it is done by voice communication using mobile or fixed-line telephone services or through the use of facsimiles. In some cases satellite phones or radio transmission may be necessary.

Regardless of the primary method used, it is a good idea to have alternative means of communication available. If the primary system fails, an option should be designed in advance that can help ensure that results are transmitted to the next level. Alternative or 'back-up'

options may involve transporting results to another location that has communications directly to the next level, or making arrangements for radio transmission with a cooperating body such as security forces.

Human resources recruitment and training

When an RMS is designed, it is necessary to assess how much staff is needed at the various levels. Compared with other models, a manual model may require more staff to be able to accomplish the work in a reasonable amount of time.

After identification of staffing numbers needed, recruitment should take place followed by training. Training should be based on procedures adopted earlier on in the process and should be done through cascade training if staff numbers are relatively high. (In cascade training, master trainers train regional/district trainers, who in turn train results centre supervisors to train staff.) If numbers are not too overwhelming, it might be better if qualified trainers train all staff, perhaps by concentrating them for training sessions at regional level. Every effort should be made to identify potential mistakes at the training stage as they could have a tremendous impact on the electoral process.

Staff are needed for the various levels of results centres. As the tasks are similar but not equal, specialized training has to be provided for staff working at different units. It is best to train all staff in all functions in order to be able to mobilize staff within a centre depending on the workload at the various stages.

Security

Security of infrastructure and personnel involved in an RMS must be considered properly and thoroughly when establishing an RMS plan. Premises have to be secured full-time and evidence-based pledges made to staff that they should be able to operate without harm to them. Coordination between an EMB and security services in this phase is extremely important. Proper identification procedures and checks have to be put in place to ensure that only authorized people can enter results centres. Background checks of staff may be needed depending on the situation on the ground.

One potential situation throughout the implementation of an RMS is that parties and candidates may come to believe that issues and concerns they raise are not being addressed in a timely fashion, if at all. In such instances they may place the blame on staff and the EMB. A subtle balance therefore has to be found between allowing complaints to be filed while ensuring that the situation does not get out of hand and endanger or in the worst case paralyze the process.

4.3.6 Advantages

Implementation possible with minimal infrastructure

The main advantage of the manual method is the greater possibility that it can be implemented under the worst possible conditions and thus in most any environment. Requirements are limited to human resources available with basic understanding of mathematical processes, paper forms and stationery to fill the forms, and calculators. There is no need for electricity, sophisticated communication systems, computer equipment, etc. If electricity is provided for, computer equipment can be used to aggregate or verify results, but there is no need to have a system to support the electronic transmission of results from one level to the next.

Sustainability more easily achieved

As there is no need for expensive or sophisticated equipment, sustainability is not a major challenge and the need for external support in terms of funding and technical assistance is reduced.

Capacity needs of staff limited

Staff only have to be trained in the addition of results with the use of calculators. Thus the individual capacity level is minimal and should be available with few problems.

4.3.7 Disadvantages

Mistakes committed due to human errors are potentially high

Because the whole process is done manually, it is more likely that some human mistakes could occur. Moreover, it can be difficult to spot them due to the possibly large number of enumerators involved. The likelihood of mistakes can be reduced by having manageable teams and strict quality control to ensure that only accurate data are released. Verification is an extremely important part of the internal work of an EMB. Parallel tabulation of results becomes imperative.

Longer time needed to obtain results

As all results are being managed manually, the time needed to operate may be greater than the time needed with the other models, especially for the release of preliminary results. This is especially the case if there are relatively few results centres or insufficient staff recruited. Lengthy delays in releasing results may create some tensions with stakeholders eager to obtain some results as soon as possible. Some stakeholders may use more sophisticated methods to obtain results and could use this information to reduce or call into question the relevance of the work done by the EMB.

More people (staff and stakeholders) needed for aggregation and verification purposes

In order to increase the speed of results management, the only factor that can be increased is the number of staff working. This may lead an EMB to recruit a substantial amount of staff, thereby increasing personnel costs and raising the possibility for mistakes to happen. Stakeholders also may need to increase their personnel numbers to be able to follow the aggregation process and undertake their own verification of results.

4.3.8 Case study: manual RMS models (Ethiopia and Sudan)

The selection of an RMS that is planned under a purely manual model, to serve as a case study, proved to be a daunting task. In most countries analysed, ICTs are being used for the transmission of results at some level of the results aggregation process. Little information is available as to which countries still use manual RMS models, mainly because of their limited exposure to external actors and development partners. However, cases still exist where ICTs are only used at the national level to verify manually aggregated results at different levels. Another recent case has been found where an EMB had to divert to the manual model because the hybrid model designed did not function as expected.

This section of the publication therefore discusses two cases: (1) the Ethiopian 2010 elections, in which a manual model was used and at headquarters level verification of results was done with the use of ICTs; and (2) the Sudan 2010 election, in which a hybrid model was put aside due to many difficulties in its implementation and a de facto manual model was at least partially adopted, without the necessary proper preparations.

ETHIOPIA ELECTIONS OF 23 MAY 2010[26]

INTRODUCTION

Elections in Ethiopia are managed by the National Electoral Board of Ethiopia (NEBE). For the 2010 elections, its structure consisted of a board and secretariat at headquarters, 11 regional offices, 43 zone branches, 547 constituency offices and some 43,500 polling stations.

The electoral system for the House of People's Representatives, the lower house of the national parliament, is a first-past-the-post plurality system for 547 single-member constituencies. The president is elected by a joint session of the two parliamentary chambers with a two-thirds majority of the vote.

26 Information gathered from the National Electoral Board of Ethiopia (NEBE) and observer reports.

COUNTING AT POLLING STATIONS

The count was done at polling station level after the closing of polls. At all 43,500 polling stations a form was used to fill in the details of used and unused ballots, as well as valid and invalid votes. It also contained the votes obtained by each candidate. According to observer reports the filling of the forms was problematic in terms of (1) consolidating ballots received versus ballots used and (2) valid votes against invalid votes. The provision of copies made by hand added an extra layer of complication into the operation.

AGGREGATION AT CONSTITUENCY OFFICE

Two different forms were designed for the aggregation of results coming from polling stations within a constituency. One (Form 8) was designed to capture and record the totals received by candidate and another (Form 10) was supposed to record the totals by polling station.

The aggregation proved difficult due to a variety of issues. One related to the decision at some constituency offices to wait until all results were in from polling stations before starting to add up results. This delayed the process. In other cases, mistakes committed during the filling of the forms at polling station level complicated matters, thereby forcing officials in some instances to amend results to be able to properly record them in forms. The use of handwritten copies to be delivered to party agents further complicated the process.

The aggregation of results finished between 4 and 10 days after the closing of polls.

VERIFICATION OF RESULTS AT NEBE HEADQUARTERS

The results from polling stations and from constituency offices were received and verified at NEBE headquarters using ICTs. The number of valid votes per candidate was assessed by observer groups as satisfactory considering the manual model used[27]; however, the same conclusion did not apply as to the number of invalid votes, total ballots and used ballots.

NEBE provided preliminary results on 21 June 2010, one month after the elections. Results were challenged by some opposition parties, with the nation's highest court declaring on 20 July the results to be final.

27 With minor mistakes due to human error.

PROVISIONAL RESULTS

In order to be able to provide provisional results, NEBE created a reporting system from polling station level that facilitated the gathering, quickly at headquarters, of information regarding the total number of votes obtained by candidates. This allowed NEBE to release provisional results for some 100 constituencies within 24 hours of the closing of polls and almost the totality within 48 hours.

SUDAN ELECTIONS OF 11-15 APRIL 2010: manual aggregation as a fall-back option[28]

INTRODUCTION

Elections in Sudan are managed by the National Elections Commission (NEC). At the time of the 2010 elections, its structure consisted of a board and secretariat at headquarters, the Southern Sudan High Committee (SSHC) in Juba and 25 state high committees (SHCs). Returning elections and constituency elections officers were in place at all states and constituencies.

The electoral system used for the election of members to the National Assembly, the lower national parliamentary chamber, and state assemblies was a parallel system, with plurality first-past-the-post (FPTP) and closed-list proportional representation for (1) political parties and (2) separate women's lists. The electoral system for the Council of States, the upper national parliamentary chamber, was indirect block vote (with representatives chosen by members of state parliaments). A majority two-round system was used to elect the presidents (of Sudan and South Sudan), and FPTP was used for governors.

THE RMS MODEL

The RMS model designed for these elections was to be hybrid, with manual count at polling stations and use of ICTs at the aggregation centres at state level. From there, according to the model, the results were to be transmitted to the national data management centre in Khartoum for final aggregation and validation.

28 This case study is based on information gathered from observer reports, including the European Union Election Observer Mission and The Carter Center Observer Mission.

NEC affirmed that accuracy was key to the aggregation process and announced its intention to implement an electronic aggregation system. The Commission later stated that the RMS would consist of a dual-entry results management system, based on an Excel spreadsheet, with special software that included safeguards to prevent fraud and human error.

The software included 11 quarantine factors that flagged polling stations with potential anomalies for verification. Polling station results that were deemed questionable included those where the number of participating voters was greater than 95 percent of the number of registered voters, the number of ballots issued to voters was higher than the number of registered voters, or the total number of votes in the ballot box was higher than the number of registered voters. If any of the 11 quarantine factors were triggered, the entry was flagged and isolated until an appropriate investigation could be conducted and corrective measures taken.

The RMS was affected by a highly complicated electoral system and a range of different elections being held at the same time. In South Sudan voters were presented with 12 ballots, with those in the rest of the country having 8 ballots to consider.

In the end, the RMS did not function as expected. There were many reasons for the poor performance, with the main ones being (1) the late decision on RMS model and practical implications; (2) polling staff not delivering the results forms, in some cases due to demands for payment before releasing the results; (3) the limited and insufficient training of some aggregation centre staff; and (4) the pressure to quickly release elections results. The various problems meant that in many cases individual states resorted to manual aggregation instead of using the hybrid system, with NEC advising all states after a few days to resort to a manual system to obtain results.

IMPLEMENTATION OF THE RMS

1. Count

The EMB had designed a results form (Form 9) to be filled in at polling stations with the results for the various elections. The reconciliation of ballots into the forms proved difficult and time-consuming, with many discrepancies slipping in during the exercise. This was one factor that undermined the proper implementation of the RMS. The results sheets and sensitive election materials were then to be delivered to the aggregation centres in the states. At this stage, polling staff in

several places hindered the delivery of results, in some cases due to payment issues (many claimed they had not been paid for their work). In addition, other logistical issues impeded the transfer of results to the state level in the stipulated time.

2. Aggregation of results

ICT equipment had been installed at the aggregation centres at state level to allow data entry into computers for double and blind input[29]. However, at the end of polling days, some states had not yet installed the equipment nor had staff been recruited and trained to manage the aggregation of results. In addition, the software for the aggregation of results was just being finalized.

The electronic aggregation was largely abandoned as officials struggled to manually aggregate results for elections that facilitated the declaration of presidential results. Most results forms (Form 9) reportedly arrived at aggregation centres with discrepancies[30], with some being received at those centres outside tamper-proof bags. In some cases chief electoral officers and data entry clerks tried to reconcile figures on those forms by altering them to fit the computerized programme. Overall, the aggregation of preliminary polling station results was not in accordance with procedures in many cases. The lack of sufficient ICT equipment resulted in a unilateral aggregation exercise – using Excel sheets without blind or double data entry. In other cases, due to insufficient human resource capabilities and/or inadequate ICT resources available, pure manual tabulation exercises were conducted and paper sheets were transmitted via fax to NEC's data management centre in Khartoum.

CONCLUSION

As has been stated in other parts of this publication, a thorough evaluation of existing pre-conditions is needed to determine which type of RMS model is likely to work best under prevailing circumstances. Being overly optimistic and relying on technology to solve problems is not always going to be successful. A comprehensive manual RMS model would have been better than having to fall back on using one partially by default, without the necessary safeguards to ensure accuracy and transparency.

29 Data entry staff were assigned two copies of the same results for data entry without them knowing who had the other copy to compare the totals at the end.

30 According to observer reports, up to 95 percent in some cases.

4.4 Hybrid/medium-tech (manual and electronic elements) model

The hybrid model is the most commonly used these days, and most of the discussions at EMBs focus on different variations of this model. These can be roughly (1) using manual components for official results and ICTs for verification and provisional results only; (2) using manual components for official results at lower levels and ICTs for other levels and for the verification of results; or (3) using ICTs for official results and verification of the results with manual data entry.

The range of ICT and non-ICT options, and the number of permutations of the two, give rise to many variations of how of this model is structured. An important point to note is that although ICTs[31] may be used at any or all steps of a hybrid RMS model, the model is defined as hybrid when human engagement is necessary. The human element involved in entering data into computers at various levels distinguishes this model from the automated model, where no human interaction is required.

Different hybrid RMSs can include, but are far from limited to, combinations of the following:

- electronic data entry of results forms at polling station level and data transmitted though telecommunications (terminals including computers, tablets, phones, etc.);
- electronic data entry of results forms at polling station level and data transmitted though the physical consolidation of removable media or terminals (terminals include computers, tablets, etc.);
- scanning of results forms at polling station level and transmission though internet or fax to results centres for onwards aggregation;
- scanning of results forms at polling station level and transmission though the physical consolidation of removable media or terminals to results centres for onwards aggregations;
- polling station results forms transmitted directly from polling centres to a national results centre where data entry takes place though an electronic system;
- aggregation of polling station results forms transmitted from polling centres to results centres where data entry takes place though an electronic system; and
- use of an optical scan voting system to scan each ballot at polling stations and count the results. Data are transmitted though the physical consolidation of removable media or terminals.

Because there are so many variations, with the above only being a few possible components, this section provides an overview of requirements to implement the hybrid model. Decisions on the specific option should be taken once the various elements necessary to implement an RMS have been assessed[32].

31 In this scenario ICTs refer to the manual entry and transmission of data to one or more servers at one or more locations.

32 For a quick guide, see Annex 2.

In hybrid solutions, ICTs are used at minimum to transmit results from one level to another. The data transmission can be either part of the aggregation or verification process.

Using data entry, an ICT solution at polling station level for aggregation purposes is in most cases an unlikely option. Such a setup requires parallel entry of results sheets and the resources needed would most probably not be worth the effort for the data to be entered. However, this option might make sense if polling centres cover a sufficient number of polling stations and therefore the number of results sheets to be entered is substantial.

4.4.1 Aggregation

1. Aggregation of results done manually

If in the version of the hybrid model, one aggregation of results is done using manual methods, please refer to Section 4.3.1 for a discussion on how to implement that approach at various levels.

2. Aggregation of results done using ICTs

In this alternative, results are received from polling stations. Results may be digitised and then transmitted from the polling station/centre, or paper polling station forms may be transmitted to either national or sub-national results centres to be aggregated using ICTs.

Polling station level

There are multiple options for the use of ICTs at polling station level. For example, the following could be conducted (it would also be possible to do both simultaneously):

- direct entry at polling station/centre level into standardised digital formats. This would put the data in a tabular format which can directly be imported into a full results database. Data may be transmitted either online or off-line; and
- scanning copies of results sheets from polling stations and transmitting to the EMB's servers. This would put the data in a digital image format that could make onwards data entry easier and limit the potential for loss of materials.

Direct entry at polling station/centre level

It may be that the financial, logistical, infrastructural and human resource capacities are insufficient to allow for data entry at each polling station. In such instances, polling centres should be provided with computers with backup mechanisms so that all results from polling stations within each polling centre are introduced once the count finishes.

The software used for data entry should have been tested thoroughly, potentially with the participation of stakeholders, to ensure that it works correctly and is unlikely to malfunction.

Stakeholders should be able to obtain a copy of the software in advance for testing purposes and then contact the EMB should they have any concerns.

Every computer should be assigned to specific data entry staff. Records should automatically be produced indicating who entered data, when data were entered, and which data were entered.

Once the results sheets have been entered into the computer, the paper copies should be collected and transported to the next higher EMB level in case any discrepancies are detected later on.

Using scanners

Another option at polling station or polling centre level is to scan the results sheets and send the data to the EMB's servers. The simplest option is to scan the image and send it as a picture for data entry at a higher level. Transmission may be done online, with the assumption that an established system or file could be physically retrieved.

The scanner ideally should be equipped with a printing option to enable copies to be given to representatives of candidates or parties for their verification processes.

Among the decisions an EMB must make are (1) at which level scanning takes place (polling station or polling centre) and (2) at which level data entry of the scanned copies takes place (municipal, district, regional or national). It may also be good to have the data entry done at various levels to double check the end results and therefore increase the credibility of results.

First level of aggregation

As with the manual model, in a hybrid RMS results centres must be equipped to handle reception of materials, verification of data, aggregation and special cases. There may be only one results centre for the entire country, or multiple results centres each assigned particular stations.

Results centre data entry

The goal of the data entry process is to enter all the results for the polling stations assigned to a specific results centre into a database. A key consideration of this is to ensure that the results entered meet the standards as assigned by the EMB.. Software used should allow staff to enter data into the database and enforce the data entry procedures. A results centre that utilises data entry can have a number of configurations, as per the variety of different processes that can be incorporated and sequences.

The data entry process can be broken down to multiple stages or reduced to only one, depending on the process chosen and the time available for tabulation. Where there are multiple stages, each stage should have a clearly delineated roles.

One generic example of a data entry process is described below.

Reception

Results sheets are delivered to a reception unit that handles intake of forms at the results centre.

At the reception stage, assigned results centre staff members are tasked with verifying the forms are as expected – primarily that they are they correctly marked with regards to the station and centre from which they originate (although this is less of a consideration with forms that are pre-printed with polling centre/station details).

Forms deemed acceptable for onwards aggregation are moved though the data entry process. If there are issues with the forms which cannot be solved immediately, the form are placed in quarantine for further consideration (which is done by a special cases unit).

Ideally a log should be made for all forms that have been received and considered acceptable. This log can be used to reconcile with which forms are still pending and be the basis to order retrievals of missing materials.

Data entry of results

Information from the polling station results forms must be entered into the database. If there are triggers or other verifications to be applied to the data entry and results, these checks can be embedded directly into the software. An effective data entry is structured as a factory, with all parts running concurrently.

In a reasonably typical process, each individual results form is entered into the database twice, in order to achieve double-blind data entry. Separate teams can be established for each entry – data entry 1 and data entry 2 (hence the use of the term 'blind'). Data entry clerks should not know the identity of the person on the other team who is entering the data for the same polling station. Physical delineation may be established between the two teams.

The paper results form can either be passed among teams for entry, or the form can be photocopied so there is one copy for each team. Another option is to scan the form and display the image on the screens when the clerk gives explicit permission to do so

The software should compare both entries to ensure they match. The system should flag for review any differences found.

There are a number of ways to deal with mismatches. For example, the form may be required to be re-entered from the first data entry. It may be preferable to review the cases, with a separate team established to deal with them. The team members would refer to the paper or image of the form to to review and understand the issue.. Depending on the permissions granted to them by the clerk, team members may choose the entered record; choose the entered record that is correct, start the entry again at first data entry, or correct the incorrect figures (though the last option can lead to tampering).

The use of double-blind data entry is effective in ensuring accuracy, but additional safeguards may be used. A quality control team may be established to review a computer-generated sample of the result entries, or all of the results entries against the original results forms. When inconsistencies are found in a form, typically that form is sent back to start the data entry process again..

In addition, the software should contain triggers that detect inconsistencies[33] in the data entry and possible fraud. These triggers should be assessed for each approved entry after it has gone through the aforementioned process. Such cases would be flagged and passed to a special cases unit.

The data entered into the system in various servers should be accessible to authorized personnel at different levels and locations for information and verification purposes.

Special cases units

Special cases units should be in place to consider the following issues, among others:

1. inconsistency in polling station result records and trigger flags. The results sheets from polling stations that are evaluated as having inconsistencies should be reviewed by a special team using previously determined procedures;

2. issues determining the origin of the form. A special cases unit should deal with cases where it is not possible to identify where a form has originated from, or when multiple forms appear to have come from the same location; and

3. complaints. A special cases unit may also manage complaints filed at polling stations (if these are permitted) regarding specific results and decide if there are grounds for the complaints. If the unit finds a complaint has merit, the standardized review process should begin and the results may be amended accordingly. If the unit decides not to respond to the complaint, the complainant should be informed about options to challenge the decision before relevant courts.

33 Examples of such discrepancies might include a higher number of votes than voters, totals not adding up, and unusual numbers of votes for certain candidates/parties.

Electoral district results

Assuming a results centre contains all the required polling stations for an electoral district, a district results sheet may be printed and signed by the head of the office once all results from all polling stations have been received and treated according to the established procedures. A copy of the results is usually displayed at the district results centre or district election office, with copies also being provided to party representatives or candidate agents in order to increase transparency of the results at this level.

National results centre

At the end of the first level of aggregation, all applicable polling station result forms should be entered into a database. However, in the case that distributed databases are used, the results have to be transmitted to a central database. Given that the data are now in an electronic format, transmission must consider how to ensure the integrity of the data.

The national results centre works with the data received from sub-national results centres – or, in smaller countries or those with single national-level districts only, is responsible for all data entry. The final aggregation of the data sources should be relatively straightforward.

Preliminary results should be released by the EMB regarding all elections. From this point onwards, complaints and challenges can be filed with the relevant authorities. Final results are announced after decisions have been taken regarding the complaints and challenges.

4.4.2 Verification

Regardless of the way in which results are aggregated (manually or with the use of ICTs), verification of the results is needed to ensure that the aggregation is correct. It can take place in a number of ways, as noted below.

Parallel tabulation
Full tabulations of polling station results forms, either paper or scans, could occur at two levels simultaneously. For example one tabulation could take place at a national results centre and the other could take place in (sub-national) district results centres. The results ultimately should be compared. The EMB may choose to make one location the 'official' and the other the verification.

Data entry at polling station or lower-level results centre
Once the count has finished, results may be introduced by a data entry clerk in a computer, and then that data could be sent to a server. The data can also be made accessible to any EMB office, as authorised.

If this is done in parallel with a results centre data entry as described in 4.3.2, then the data can be digitally compared for discrepancies.

If this is done in parallel with a manual aggregation, offices at the same or different levels can manually compare the two to either confirm the results or detect possible discrepancies. At national level these data can be used to release provisional results.

National computing centre

The data used for verification purposes are received at the national computing centre (not to be confused with the national results centre). The results centre manages physical and official results, while the computing centre deals with electronically transmitted provisional and/or preliminary results. Even if the results are being aggregated using ICTs and no paper copies are provided, it is good to have separate computing and results centres in order to deal with different issues that may arise during the aggregation and verification of results.

Various safety features should be introduced to ensure that the information transmitted to the national level is indeed the information emerging for the polling station results sheets. For security reasons, it is imperative that data are transmitted to the national computing centre using VPN (virtual private network).

Identification of user and kit

The person charged with operating the equipment at each polling station or district results centre should obtain in advance a code to access a computer. Each computer is identified by a unique code to avoid 'false' computers to send data. Two important identification-related components should be kept in mind. For one, each data package should have a digital signature for identification purposes. Also, digital signatures of polling staff and all party/candidate agents at a polling station or district should be obtained.

Option 1: scanned copies

Scanned copies of polling station results are transmitted via VPN to the national computing centre – not to be confused with the national results centre, as noted above – for further treatment. Upon reception, copies are immediately sent to political parties for their information and validation.

This step uses two data entry points for verification purposes. Two identical images are sent to data entry clerks without either one knowing who has the other copy. The results have been previously 'cut and pasted' by a special computer programme to make it impossible to detect for which candidate or party the data entry clerk is entering specific results.

If both data entry clerks provide the same results, the results are validated and can be published by the EMB and released through press conferences. If differences exist between

the results inserted by the data entry clerks for the same results, an audit takes place to determine the real value and the origin of the error(s).

Option 2: data entry at polling station or lower-level results centre

Once the results arrive at the server at national level, they are aggregated either using a computer programme or through the use of data entry clerks for the various constituencies. These data are not only used to provide provisional results, as stated earlier, but also to verify the accuracy of data coming from the state level. The EMB therefore has a greater likelihood of detecting possible differences during the processing at the lower levels and undertaking corrective measures early on.

If mixed aggregation is to happen, there has to be clear agreement by political parties and candidates for the use of the system in this manner. Also, legal provisions should mandate or support such an approach.

Stakeholders

Political parties, candidates and observer groups require access to the data being aggregated by the EMB to be able to compare them with results emerging from their own sources. Further, it is valuable to post polling station level disaggregations so political groups and observers can review such information against their PVT-collected data. In some cases, computers with 'view-only' and print capabilities may be made accessible to enable stakeholders with access to view the station level aggregations.

Manual and ICT aggregation mixed

For the announcement of preliminary results, an EMB in some cases may decide to mix the results obtained with the use of ICTs and manual aggregation. In such instances, only the results from polling stations without the technological possibility to transmit data are added to the already existing data to obtain the preliminary results.

4.4.3 Publication

Physical results

Paper copies of results are normally released in the form of printouts and reveal the results obtained at polling stations and results stations for the different elections held. The copies are released after the totality of votes or results sheets have been treated at the specific level.

Electronic results

The first set of information (raw data) can potentially be published where polling stations directly report results in a manner that can be rapidly aggregated. However, such results are typically not reviewed and have few checks for correctness. As such, their release should depend upon the particular context.

An EMB typically releases results data – as consolidated from various results centres – in press conferences at a media centre. That information is intended to provide preliminary results and give indications as to how the process is progressing. For this to be possible, the EMB has to be in possession of sufficient data (and from different areas of the country) to be sure that these progressive results released are not significantly different from results based on far more polling stations and areas of the country released later, including final ones. The EMB should decide prior to polling day as to the amount and origin of data required to start releasing results.

If a website has been created by the EMB to release results, it should be tested properly before polling day to be sure that it can accommodate the maximum expected number of visits and not break down. A malfunctioning or 'crashed' website could be a trigger for possible allegations of foul play.

Many cases are documented in which EMBs decided to release results very early in response to pressure from stakeholders, only to realize that the next set of results changed the first results dramatically because, for example, the newer set came from different regions. In such instances, losing parties often have claimed fraud.

4.4.4 Requirements

Concept, timeline, budget

One of the first steps towards designing a RMS consists of drafting a concept note, which should include a timeline and tentative budget. The concept note should include general explanations about the RMS, potential partners, specific activities envisaged and anticipated challenges to implement it.

While it is important for all stakeholders to be on-board in the design of the RMS, the drafting of the concept note should be an internal EMB activity. The concept note can be shared with stakeholders for comments further down the line. The process could be delayed unnecessarily at this early stage if the involvement of stakeholders happens too soon.

Realistic timelines and budgets should be provided to allow the EMB to take a careful, fully informed decision on a proposed RMS.

Legal requirements

Existing legal provisions frame the work an EMB can undertake while designing an RMS. In some cases legal provisions may be silent in regards to results management, thereby allowing an EMB complete liberty to design whatever RMS it deems appropriate. In other contexts or environments, however, existing legal provisions may apply, such as requirements regarding the level of results aggregation, the transmission of paper copies or the provision of information to specific bodies, etc. These restrictions must be considered by an EMB and legal counsel should probably be sought if the desired design might conflict with possible interpretations of legal provisions. The next steps can be considered and undertaken only after the legal framework is clear and no doubts exist as to their impact on the design of an RMS.

Drafting procedures

Usually an evaluation has been conducted of the RMS that was last used; lessons learnt from that exercise can feed into the design of a new RMS. Procedures should be drafted covering all aspects related to a new system, including the various levels of results aggregation, verification and publication. These procedures serve as the basis for discussions with stakeholders and preparation of training manuals for staff involved in implementation.

Premises

Premises (physical space) need to be secured for the various levels of results centres. Sufficient space should be allocated inside each centre for the reception, aggregation, and special cases units as well as the work of district-, regional- or national-level electoral officials.

Decisions about space may depend on the hybrid model option selected. The possibilities range from having only polling stations inside a polling centre and a national computing and results centre (if ICT aggregation and verification is selected) to having polling stations at polling centres plus local/municipal, district, regional and national centres.

As soon as possible, the following should be designed and distributed: flow charts for information and transmission of paper copies, organograms for the staff assigned to each unit, and drawings with space allocation inside each centre. Space is also needed to store materials accompanying the results – e.g., bags with ballots and other equipment used during the polling. Special space has to be secured for ballots being put in quarantine. And finally, provisions should be made in advance for space for stakeholders to be able to follow the process.

Equipment, materials and forms

The equipment, materials and forms necessary to implement the various phases of an RMS should be identified early on to enable timely procurement, testing, design and use of equipment, materials and forms in training sessions.

Materials range from stationery to whiteboards and other items needed to facilitate the manual aggregation, verification and publication of results. Equipment normally includes calculators and in some cases computers and printers to introduce results in spreadsheets and print them out. That process may be done either for aggregation or verification, or for both purposes. However, it can also be the case that projectors and other equipment may need to be procured.

The amount and type of equipment varies depending on the level it is assigned to. If the basic hybrid option is used, the most 'advanced' equipment at polling station level is likely to be calculators – but in results management centres at the various levels the number of ICT equipment (e.g., computers, scanners, modems) is very important[34]. Experience indicates that at a national computing centre, more than 100 terminals may need to be connected to various servers for data entry.

A range of different forms is needed for an RMS to work efficiently at various levels and for the various units involved each time. These forms should be prepared far enough in advance to allow their use during the training of staff at the various levels and units. To help ensure processes move smoothly, those individuals need to familiarize themselves with relevant forms before using them during a real electoral event. Also, staff may discover some glitches or mistakes when using them in practical training exercises; time therefore has to be available to redraft the forms if needed and print them before polling day.

As always, spare equipment, materials and forms should be on hand to be dispatched if needed to centres requesting additional items due to unforeseen circumstances. Normally, at least 15 percent extra stock (equipment and materials) should be available.

Software

Software is a key component of a hybrid data entry. It will need to reflect the data entry process and mirror the procedures. Because software plays such an important role, procedures must be completed early in the process to all sufficient time for software development, testing and training of staff..

Typically tabulation software is built bespoke for a process and may be purchased from a

34 If an advance hybrid option is used, such equipment will already be present at polling station level.

software firm. Depending on the licence it may be proprietary or open source. For example, UNPD supported the Libyan government in building open source data entry software for the country's two most recent elections (as of July 2014), which has been made publically and freely available[35].

Communications

The first level of communication is from polling station to headquarters in order for heads of stations to transmit provisional results. This communication can be undertaken in various ways, but most commonly for basic hybrid versions it is done by voice communication using mobile or fixed-line telephone services or through the internet or the use of facsimiles. In some cases satellite phones or radio transmission may be necessary.

Of note is that the amount of data transmitted from polling centres could be substantial if the option of scanning copies of the results sheets is used. Thus it is important to ensure in advance that the transmission systems are able to handle the expected amount of traffic.

Regardless of the primary method used, it is a good idea to have alternative means of communication available. If the primary system fails, an option should be designed in advance that can help ensure that results are transmitted to the next level. Alternative or 'back-up' options may include (1) having several internet providers on standby in case one breaks down during or before the transmission of results, or (2) transporting results to another polling centre nearby that has communications directly to the local/municipal level. Other means of communication from a cooperating body could also be secured in advance.

Human resources recruitment and training

When an RMS is designed, it is necessary to assess how much staff are needed at the various levels. Compared with other models, a hybrid model may require more staff to be able to accomplish the work of aggregation and verification in a reasonable amount of time.

After identification of staffing numbers needed, recruitment should take place followed by training. Training should be based on procedures adopted earlier on in the process and should be done through cascade training if staff numbers are relatively high. (In cascade training, master trainers train regional/district trainers, who in turn train results centre supervisors to train staff.) If numbers are not too overwhelming, it might be better if qualified trainers train all staff, perhaps by concentrating them for training sessions at regional level. Every effort should be made to identify potential mistakes at the training stage as they could have a tremendous impact on the electoral process.

35 See https://github.com/onaio/tally-ho.

Capacity levels vary depending on the tasks staff members are assigned to. Staff assigned to manual aggregation typically require less capacity than staff involved in data entry and verification. Depending on the option of the hybrid model selected, manual aggregation staff and/or data entry clerks are required at various levels. The national level should require, other than personnel for dealing with special cases, almost exclusively data entry and reception staff. Staffing numbers vary by context, but for national computing centres figures of some 400 data entry clerks are common because several shifts (e.g., four separate six-hour shifts) should be planned to allow smooth and continuous data entry.

Staff are needed for the various levels of results centres. As the tasks are similar but not equal, specialized training has to be provided for staff working at different units. It is best to train all staff in all functions in order to be able to mobilize staff within a centre depending on the workload at the various stages.

Security

Security of infrastructure and personnel involved in an RMS must be considered properly and thoroughly when establishing an RMS plan. Premises have to be secured fulltime and evidence-based pledges made to staff that they should be able to operate without harm to them. Coordination between an EMB and security services in this phase is extremely important. Proper identifications procedures and checks have to be put in place to ensure that only authorized people can enter the results centres. Background checks of staff may be needed depending on the situation on the ground.

One potential situation throughout the implementation of an RMS is that parties and candidates may come to believe that issues and concerns they raise are not being addressed in a timely fashion, if at all. In such instances they may place the blame on staff and the EMB. A subtle balance therefore has to be found between allowing complaints to be filed while ensuring that the situation does not get out of hand and endanger or in the worst case paralyze the process.

In addition, security protocols should be in place regarding data entry, transmission and access to avoid unauthorized access to data and possible tampering. An audit of the system should be undertaken prior to polling day, ideally by an external, specialized and reputed company. All safeguards should be used and verified during the implementation of the RMS.

4.4.5 Advantages

Reduced time for the release of provisional results

The main advantage of the hybrid method is that it considerably reduces the amount of time needed to release provisional results. It can provide information fairly early, and easily,

Design of forms and identification and procurement of equipment and materials should be done early on to allow their use during training and test runs by staff assigned to work on an RMS.

to stakeholders as to how the results are shaping up through a variety of systems (e.g., website, media centre).

Facilitate verification

The data gathered at the various levels can be used by the EMB and stakeholders to verify/validate official results and correct possible mistakes in less time and more accurately than with the manual model.

4.4.6 Disadvantages

Need for certain level of existing infrastructure

For the hybrid model to operate, some minimum requirements exist as to available infrastructure – mainly related to a communications network. Even if ad hoc communications can be set up for the elections, experience has shown that short-term or quickly developed solutions may backfire if not properly implemented over a sufficient amount of time.

Sustainability can become an issue

Due to the need for ICT equipment and specialized software, a substantial amount of funds must be set aside to ensure that the system operates adequately. This may have a major impact on the overall electoral budget; thus the EMB should try to ensure that equipment purchased can be used for other tasks once the elections are over (or can be provided by another agency for electoral operations). Another consideration is that the speed of technological innovation renders some equipment obsolete for the next cycle of elections. For that reason and others, a proper study should be taken and arrangements made beforehand for other institutions, governmental or non-governmental, to benefit from the equipment purchased.

The costs associated with the use of the equipment relate to visible and invisible costs. Visible ones are those linked to the immediate purchase of the equipment, while invisible costs are those regarding maintenance, upgrades of software, etc.

A proper evaluation should be made as to the value-for-money balance. If external funds are used for the purchase of the equipment, the question has to be raised as to whether these funds will also be available for future elections or if it is better to stick to more economical methods for the RMS that can be implemented with the national budget.

Capacity needs of staff increased

Staff capacities increase with the introduction and use of ICTs. A proper study has to take place to assess if sufficiently qualified staff exist to implement the model at the various levels. If there is the need to move staff from one central location to decentralized ones, an assessment should be made as to whether staff numbers are too high to merit their use in such locations. It may be appropriate to adapt/simplify the model instead (e.g., use data entry only at national level).

4.4.7 CASE STUDY: HYBRID RMS MODEL (**BANGLADESH**)

SUMMARY

The Election Commission Bangladesh (ECB) planned to roll out a new version of the electronic component of its RMS for the parliamentary elections held in January 2014. This component was designed to complement, though not replace, the official manual results process. The electronic component was conceptualized as offering a useful tool for the Commission to cross-check, verify and speed up the results aggregation process. As such, it was assumed, the component would aid ECB in increasing the efficiency and accuracy of election results in order to generate greater confidence in this overall process and in the Election Commission, as an institution.

This case study provides background information on the RMS in Bangladesh and discusses some of the factors considered for the introduction, including a range of technical, operational, legal and political considerations. Among the lessons learnt from the case study is that through adequate planning, piloting, testing and risk management, a revised version of an RMS can be successfully delivered.

(Note: UNDP Bangladesh provides ECB with electoral assistance and supported the development of the new version of the RMS.)

Guiding principles for the Bangladesh RMS

- The electronic component of the RMS should seek to enhance the efficiency of the manual paper-based process, not replace it. The manual results process remains the official and legally recognized processes.
- Development of this component is premised on an assessment of the existing situation, gaps and needs. Constant reviews of context must be conducted to remain fully aware of the challenges and opportunities.

- A reasonably sized project that is realistic to implement should be maintained.
- Information from pilots and lessons learnt should be used to enhance the robustness of the system.
- Sufficient time must be allocated for implementation.
- Clearly defined objectives for the system should be maintained, and steps should be taken to ensure that these are properly communicated to prevent any misunderstanding.
- Constant reviews should be undertaken to recognize and anticipate the political implications of the RMS in the Bangladesh context.
- Proper training, professional staffing and voter education regarding the system should be ensured.
- The system should be sustainable for the future. Thus it is important to recognize its total cost, the cost for review and upgrades, and the existence of in-house capacity to maintain it.

RMS PROCESS

The RMS starts with the manual casting and counting of votes at polling centres. Following the counting of ballots at those centres, the officially agreed results for each polling centre is then entered by hand on a results paper slip. This official manual aggregation process continues at various levels.

The results slips are taken to the electronic aggregation point. At the aggregation point, a data entry operator scans the image of the results slips and enters their information into the RMS. A double-blind entry system is used wherein the same form is entered twice (each time by a randomly selected data entry clerk, in order to prevent collusion) and then compared. The system can then perform automatic checks such as comparing the number of votes cast with the total number of registered voters for that area or the total numbers of votes cast with the number of votes for each candidate and spoilt votes.

After the checks are passed, the system flags the results for authentication. An assistant returning officer (ARO) then selects each flagged result in turn (from the list of results that passed the initial checks) and compares entered data with the scanned image. Each discrepancy is reviewed and returned by the ARO for recapture. If all is well with the entered data, the ARO can authenticate individual results slips in the RMS.

Authenticated results are transmitted to the central RMS database. The implementation of the RMS used in January 2014 required the development of a software solution and the establishment of 520 data aggregation centres at the upazila level (an administrative and electoral sub-division), each with an RMS kit including a laptop, scanner and software as well as other minor accessories.

SCALE AND COMPLEXITY OF THE RMS

The voter population in Bangladesh is approximately 92 million people, after the 2012 update of the voter list, making it among the largest in the world. Considerations that relate to the complexity of the endeavour include the number of different elections held on the same day; whether multiple and/or new technologies are being introduced; whether the official results process is being changed; the nature of the coordination mechanisms; prior experience of the Commission with similar scale projects; and timeframes involved for implementation.

BACKGROUND TO THE INTRODUCTION OF THE ELECTRONIC COMPONENT OF THE RMS

Prior to 2014, ECB had previously developed and piloted two different versions of the electronic component of the RMS. A third version was developed for use in the parliamentary election held in January 2014. The concept for Version 3 was informed by an assessment of the previous two versions, including their strengths and weaknesses as well as with due consideration for the technical and operational realities of Bangladesh.

PILOTS AND LESSONS LEARNT

In keeping with best practice – e.g., it is advisable to pilot technologies to be used in elections prior to rolling them out nationwide – early versions of the updated Bangladesh RMS model were piloted in six different local elections during 2012 and 2013. Observations and feedback from lessons learnt workshops with electoral stakeholders helped influence an enhanced Version 3 of the system.

Lessons from countries such as the Democratic Republic of the Congo, Kenya, Pakistan, South Africa and the United Republic of Tanzania – places where hybrid results systems have been used with varying degrees of success – filtered into the design of the Bangladesh system. This, too, can be considered a best practice approach.

ASSESSMENT AND RISK ANALYSIS

An assessment of technical, operational and legal aspects of implementing the RMS was carried out. Key elements are outlined below.

TECHNICAL ASPECTS

Data communication infrastructure

It was deemed essential to ensure adequate data communication modalities and appropriate contingencies, when necessary, for the new RMS to be successful. ECB's decentralized locations (upazila level) already have and use data connectivity through an existing virtual private network (VPN) arrangement with one of the mobile carriers.

Risks mitigation approach and contingencies. It was deemed in advance that the system would:

- have alternative mobile data channels,
- use USB removable media if necessary,
- encrypt all data at source and during all transmission,
- use a store/forward architecture and fault-tolerant RMS software,
- have spare hardware ready for rapid deployment,
- re-use RMS kits in multiple locations if necessary,
- use fax machines to transmit protocols if necessary, and
- use voice (telephone) to transmit results if necessary.

Electricity at sites

Access to electricity is unevenly distributed across Bangladesh. This is a concern because the RMS requires access to electricity for optimal performance. ECB conducted a check of the actual situation in polling centres proposed to be utilized for the January 2014 parliamentary elections that included the status of electrical connection. This information was used to support the selection of data aggregation sites, with priority given to sites with active and reasonably robust electric connections.

Risk mitigation

ECB has established an agreement with relevant government authorities that electricity should be provided, without interruption, to polling centres during an election. As a contingency ECB decided to have generators on standby. Importantly, laptop computers were deployed – thereby offering the opportunity, in the event of power disruptions, for battery power to be utilized for a period of time.

Technology and equipment required

The system assumes the existence of almost 600 data-capturing sites all equipped with RMS kits. In addition, basic equipment was provided, such as projectors and

screens for display of results at the central level. Capacity to send facsimile was ensured, just in case other options for submitting results failed.

Risk mitigation. The following steps were taken as part of risk mitigation efforts related to required technology and equipment:

- procurement of equipment was handled through the UNDP Procurement Support Office (PSO) in Copenhagen for professional procurement services. Delivery of equipment was achieved well in time prior to the elections;
- the UNDP Country Office designated a procurement focal point for election procurements to ensure timely and more effective processes. A similarly designated focal point exists within ECB;
- UNDP Long Term Agreements (LTAs) were used to get the best prices possible and reduce procurement times;
- all equipment provided was standard issue to reduce complexity of use, such as standard computers that run Microsoft .NET. No complex or unfamiliar equipment was utilized;
- the equipment can be easily reused for purposes other than electoral events because there was no need for the customization of equipment for the RMS. For example, the equipment procured for the RMS was also successfully used for a candidate management system developed at the same time as the RMS (though not detailed in this case study);
- most ECB field offices were already equipped with facsimiles machines before the new RMS was implemented;
- pre-testing of equipment was undertaken before deployment and use in the elections;
- ECB IT staff familiar with projects of similar scale, such as voter registration, served as operators and helped provide support to the technical development and implementation of the new RMS components; and
- a senior project management advisor was hired sufficiently in advance to help ensure that all processes went smoothly.

Capacity of staff

The design of the system assumed a range of competencies among ECB staff. Among other things, these competencies related partly to development of the software as well as the installation of the electronic component of the RMS and other hardware. The designated new system also indicated the need for data entry skills and some level of technical/maintenance skills on polling day.

A total of 18 staff worked on software development of the RMS. They included 10 IT personnel from ECB's ICT department and 8 from the UNDP-supported project.

Among them were an international ICT advisor and two international software developers with prior experience with producing similar systems. A local software development company (CMMI-certified) also provided helpdesk services for a number of large organizations in Bangladesh and was contracted to provide ICT helpdesk service for RMS users during the January 2014 elections.

Risk mitigation. The following priorities were specified as part of risk mitigation efforts related to staff capacity:

- use COTS (commercial, off-the-shelf) hardware,
- train users properly and in good time, and
- encrypt all data at source.

LEGISLATIVE FRAMEWORK

In Bangladesh and any other context, any RMS implemented should comply with the existing electoral legislative framework Manual processes and procedures at the core of the previous RMS in Bangladesh were retained in part because they are required by law and underpin the official results process. However, initial review of the law suggested no immediate barriers to the use of a complementary hybrid RMS for the new model. A senior local electoral lawyer conducted a more detailed legal review that considered the main electoral law and any parallel or subsequent legislation/ rules.

FINANCIAL RESOURCES FOR PROJECT

All the funding required to implement this project was available in adequate time. UNDP Long Term Agreements (LTAs) with vendors were used to the maximum extent possible to ensure cost-effectiveness in the procurement of the RMS kit hardware.

TIME-FRAMES

The new Bangladeshi RMS was implemented through a phased process over approximately 14 months beginning in 2012. The process included the development of two versions of the system followed by a third finalized ahead of the January 2014 parliamentary elections.

For software development planning purposes, the RMS functionality was prioritized in the following manner (with priority in descending order):

- 'mandatory functionality' that is absolutely required prior to initial deployment;
- progressively beneficial functionality (as time permits); and
- additional functionality that could also be incorporated after the parliamentary election for use in subsequent elections.

Plans and schedules for the phased approach permitted sufficient time to develop, procure, test and train for all the components of the new RMS. Key dates and deadlines in the process outlined in advance are shown in Table 3 below.

Table 3. Planning timeline for key tasks: new RMS in Bangladesh

TASK	TASK TIME-FRAME
Development of Version 1/2	2012 and February 2013
Pilot of Versions 1 and 2 of RMS 2012 and 2013 Examination of legal requirements pertaining to RMS	1 to 19 July 2013 August 2013 (more detailed review)
Conceptual design for Version 3 of RMS (broad functionality and workflow) – including linkage to other systems	10 to 31 July 2013
Lessons learnt workshop	31 July 2013
Development of RMS graphical user interface	28 July to 15 August 2013
RMS Version 3 prototype – indicative user roles as per user processing activities (done mainly to aid client consensus and aid final adjustment of system workflow design)	18 August to 15 September 2013
RMS Version 3 software development	15 September to 30 November 2013
RMS user documentation and training material	10 to 30 November 2013
RMS user training and field tests	1 to 5 December 2013
RMS deployment of kits and users to field offices	8 to 12 December 2013
Election day support	10 December 2013*
*When the development plan was introduced in 2012, it was not known when the elections would be held. It was understood that more or less time could be available for support depending on the final date set for elections.	

SUSTAINABILITY

The RMS was designed in such a way to ensure that ECB is able to develop, review, upgrade, maintain and replace with ease any of the system's components to ensure that the RMS can remain secure and trustworthy.

Substantial capacity for software design already existed within ECB. The RMS can therefore be further developed in-house.

ALL SOURCE CODE WAS HANDED OVER TO ECB.

Training of the data clerks utilized for data entry at the field level was undertaken prior to the deployment of the IT equipment in the field. The training of trainers (ToT) methodology was utilized, thereby creating a pool of skilled trainers capable of replicating the training should ECB need to roll out a future version of the RMS.

The computer equipment procured for the RMS should be usable for up to five years, assuming adequate maintenance and proper care. That should mean it can be used for subsequent parliamentary elections and beyond. A total of over 600 kits were purchased for the January 2014 elections; approximately 50 of these kits were utilized to maintain the RMS for local and mayoral elections. The balance are to be used to enhance the decentralization of the voter registration process, which is a main support area of UN electoral assistance, and can be used to replace and provide equipment for local election offices where voter registration takes place.

Broader sustainability was achieved since the majority of the equipment, such as laptops and scanners, is standard and not customized in any way.

4.5. Automated/high-tech model

4.5.1 Description

Fully automated results management is, by definition, possible only when electronic voting and counting technologies are implemented and used. An important distinguishing characteristic from other RMS models is that fully automated results management systems should not allow any human handling of results, or direct interaction with them, whatsoever.

Where results have to be physically moved from polling stations – because they are within the electronic voting/counting machines, or on removable media – such movement can be delayed, perhaps indefinitely (as might need to be done if equipment is lost or stolen). But at no stage can any of the results data in a fully automated system be controlled by humans. Unsurprisingly, cryptographic technologies and protocols have an important role to play in regards to such systems.

In any RMS model used, from fully manual to fully automated, the following end-of-the day procedures are initiated by polling officials at each polling station after the last voter has cast a vote and the polling station is closed:

- secure storage of results on removable media,
- secure transmission of results via available communications channels, and
- statement of poll results or reporting on screen or on paper at the polling station.

One important aspect of results management systems, namely the publication of results on the internet, is increasingly being automated using data visualization tools and digital mapping. Some EMBs[36] have either in-house developed or issued contracts to software firms to deliver interactive publication of election results. Others develop in-house solutions[37]. Increasingly, EMBs provide near real-time access to provisional or verified elections results data, thereby allowing all stakeholders – the media sector, political parties, national and international observers and the general public alike – to see and review the same data that they have. When such data include results from the polling station level, the RMS may be described as optimally transparent.

36 Mexico's Instituto Federal Electoral (IFE) and Kenya's Independent Electoral and Boundaries Commission (IEBC) are two examples of collaboration between Google and an EMB. Information is available, respectively, at www.ine.mx and http://vote.iebc.or.ke/.

37 For example, South Africa. See www.elections.org.za/content/Elections/Election-results-maps/.

It is instructive that two countries with advanced electronic voting systems (Venezuela[38] and Brazil[39]) both require that the statement of poll be printed and displayed at the polling station. As such a requirement indicates, trust begins at the beginning.

Note: The discussion below provides an overview of structures and processes in a 'typical' fully automated RMS model. Variations occur in different contexts and environments.

4.5.2 Electronic voting and counting technologies

This topic is enormous and beyond the scope of a basic RMS manual, but a brief discussion of electronic voting and counting technologies from an RMS perspective is warranted.

Electronic voting and counting technologies usually fall into the following categories:

- electronic ballot printing,
- precinct count or ballot scanning,
- DRE (direct recording electronic), and
- internet voting.

Increasingly, the demand for some physical artefact from DRE and internet voting systems has led to what are called voter-verified paper audit trails (VVPATs). Solutions vary. In some VVPAT processes, each voter is issued a paper receipt that records the fact he or she voted, though not the choices made. Others may display a voter's choice on a paper roll visible to, but not given to the voter. Internet voting systems may issue digital versions of these paper trails (perhaps in PDF format.)

The use of VVPATs underscores the fact that some types of electronic voting systems do not facilitate full automation of results management because they may include some human involvement, such as the recount of polling station paper results. Automation is therefore a spectrum.

4.5.3 Requirements

In general, the greater the level of automation in an RMS, the more time must be allocated for preparation and introduction, with particular emphasis on substantial testing both of functionality and at load.

38 The 'Acta de Escrutinio' are printed in at least seven copies by the electronic voting machine and distributed. Additional copies are printed on demand so long as there is paper in the printer. See www.cne.gob.ve/web/normativa_electoral/elecciones/2013/municipales/documentos/Manual_Miembro_Mesa.pdf (in Spanish).

39 See www.tse.jus.br/noticias-tse/2013/Setembro/serie-urna-eletronica-do-armazenamento-dos-votos-a-divulgacao-dos-resultados (in Portuguese).

With that in mind, all of the requirements elaborated in Section 4.2. are nevertheless relevant in regard to a fully automated RMS model. (To reiterate, the requirements in that section are discussed within the following categories: legal; drafting procedures; premises; equipment, materials and forms; communications; human resources, recruitment and training; and security.)

It is important to ensure that legal provisions that protect the secrecy of the ballot in an electronic voting system do not have the effect of limiting the transparency of the associated automated RMS. This includes the possible use of ballot secrecy as an excuse by an EMB to limit the transparency of an RMS, to withhold results, or to deny reasonable recount opportunities.

At first glance, two other essential requirements of electronic voting systems and results management systems – confidentiality and transparency – appear irreconcilable. An effective RMS is characterized by full transparency in which every result can be traced to its polling station source. Electronic voting systems must first and foremost protect the secrecy of the ballot to shield voters from intimidation and prevent vote buying or family voting (among other corrupt practices). At the same time, electronic voting systems must offer sufficient transparency to permit an EMB and any authorized stakeholder (for example, an elections tribunal or court investigating a petition) to conduct audits. Great care must be taken to guarantee that no electronic 'ballot' can be associated with its voter where voter lists have been replaced by electronic voter identification (or authentication) devices and those devices are integrated with or even connected to electronic voting systems.

The seemingly competing requirements of confidentiality and transparency can be delivered in a single system, but at a cost – both financial and in terms of complexity. The science of cryptography is delivering new protocols (or applying old ones) to the task of delivering end-to-end verifiability[40]. These are systems that deliver the necessary transparency and auditability while maintaining the secrecy of the ballot.

4.5.4 Feasibility studies

Electronic voting and counting are central components of a fully automated RMS. The countries that have achieved greatest success with electronic voting (Brazil and India are the most prominent) have done so because they have taken a long-term, gradual approach to the evolution away from paper balloting. Some countries have gone from zero to 100 percent electronic voting in a single electoral cycle, but those are the exceptions.

40 A useful explanation of this concept may be found at: www.usenix.org/legacy/event/sec05/tech/full_papers/karlof/karlof.pdf.

Feasibility studies for elections technologies are multidisciplinary undertakings and should involve, in addition to IT experts, those with skill and experience in election law, training, finance, operations, logistics and outreach.

Too often, feasibility studies focus on how a technology should be implemented rather than addressing the more fundamental question of whether a technology is appropriate in the first place. EMBs and their development partners can also fall into the trap of assuming that IT expertise alone is needed when considering the feasibility of a technology.

4.5.5 Procurement

Some EMBs, particularly in large countries, have been deeply involved in the specification and manufacture of their electronic voting systems (and therefore any fully automated RMS). However, for the most part, EMBs and countries lack the resources (either financial or human) for such an undertaking. Accordingly, they procure solutions from specialist vendors.

The following stereotypes are frequently cited with respect with respect to the procurement and implementation of elections technologies. But like all stereotypes, they persist because at their core, they contain elements of truth:

- procurement takes longer than anticipated or considered likely;
- at the end of the process, more money will have been spent than originally projected or assumed;
- technology does not solve all the problems implementers expect it to; and
- technology introduces some problems of its own.

Large-scale public sector information technology projects are notorious for running late and over budget. The introduction of electronic voting and counting technologies and their associated automated results management systems are not immune to this phenomenon. The challenges of resource mobilization for elections, particularly in developing and post-conflict countries, means that whether the envisaged technology is funded from national budgets or with donor support, the available time to procure, evaluate, implement and support new systems is highly compressed. The cost of any solution inflates rapidly as timelines shrink. Unanticipated costs mount as EMBs scramble to hire more technical staff and deal with transport, storage, maintenance and infrastructural challenges including power, air conditioning, networking and related expenses.

Procurement may take the form of an invitation to bid (ITB) or a request for quotation (RFQ) accompanied by detailed requirements specifications. Alternatively, a more general request for proposals (RFP) may be issued. Any of these may be preceded by pre-qualification or a call

for expressions of interest (EoIs) to weed out opportunists and narrow the field to genuine and capable vendors.

Considerable time is necessary to prepare the technical and operational requirements and specifications that should accompany an ITB or RFQ. While it is tempting therefore to issue a more general RFP, that approach requires more time at the back end as disparate proposals, which may be difficult to compare, are evaluated.

Regardless of the procurement model chosen, a significant amount of time needs to be spent by many people – technical, financial, and operational, both within and from outside an EMB – to ensure that the procured solution meets the real needs.

Good planning is key to successful elections management. Therefore, detailed and unambiguous requirements specifications are critical starting points for successful procurement.

At the other end of the procurement spectrum, EMBs that have only decided that they wish to invest may invite the manufacturers and vendors of electronic voting systems to propose solutions. While observing elections overseas or on study trips abroad, EMB officials (or other stakeholders, often politicians) may see solutions in use there. Vendors may unilaterally approach EMBs and offer their products. Representatives from EMBs may attend conferences or trade fairs where they see solutions offered by vendors.

Contrary to popular belief, not all vendor interaction is characterized by dishonesty and trickery. In general, though, so-called vendor-led procurement is inappropriate because it seldom places the needs of an EMB or country above those of the vendor. This is not intended to demonize vendors, which should be embraced as partners in any major electoral technology project. However, it is highly recommended that EMBs be both vendor-neutral and technology-neutral until meaningful feasibility and pilot studies have been undertaken to reliably determine their specific countries' needs in the area of electoral technology.

Incremental introduction of technologies allows the competitiveness that characterizes procurement best practice to continue longer into the process and helps EMBs avoid vendor lock-in. Large countries can ensure that competition between vendors is an ongoing feature of their procurement. Having multiple vendors deliver solutions that comply with an EMB's specifications means that should any vendor fall below expected standards or performance, another vendor's proportion of the ongoing procurement can be increased. Small countries may not have this option and, particularly with electronic voting systems that tend to be highly proprietary, some degree of vendor lock-in is inevitable.

Finally, it is vital to note that while an EMB can procure the manufacturing and development, testing and certification of systems including an RMS, and can even outsource much of the operational and support functions, it can never outsource the responsibility.

Procurement of elections technology is too critical for an overall project to be left to amateurs and novices. EMBs and development partners alike that engage in such procurements should ensure that they get training and support from such agencies as the UNDP Procurement Support Office (PSO) in Copenhagen. This recommendation applies even if the procurement is not being conducted by UNDP. PSO's procurement training is generic and offers generic international procurement certification. The unique advantage is that the training can be customized for an election-specific audience, thereby adding great value.

Considerations when procuring automated results management include the following:

- Will results be available at the polling station?
- Will results be printed out from the system or will polling officials have to complete paper forms for posting results at polling station and share with party and candidate agents and observers?
- What provision is there for a recount at a polling station?
- If there is a VVPAT, how will the outputs be handled?
- If there is a recount, how are the results handled?
- How will results be transmitted from the polling station? Will there be a single channel or will there be a redundant channel?
- What communications links are required?
- How will results be stored centrally?
- Should the system allow voters to confirm that their vote is included in the results?

4.5.6 Fraud mitigation and security

Fraud mitigation

It is important to keep in mind that those who would improperly manipulate elections will, if one avenue for fraud is closed off, shift their attention to another. Polling station fraud is inhibited or prevented by the use of such electoral technologies as biometric electronic voter identification devices, electronic voting systems or fully automated results management systems. Therefore, would-be transgressors instead turn to other phases of the electoral process (e.g., voter and candidate registration or the use of media) to influence the outcome.

Security

Physical security is a basic consideration. Where will the equipment be stored prior to and after the election? Who has access to this location? Are there adequate safeguards to control the receipt and issuing of materials and equipment? Is there clear traceability of all materials and equipment?

As election day approaches, and the systems are prepared for the upcoming polls, there must be clear procedures to address how the following security-related issues handled:

- software or firmware updates to equipment,
- any keys used to encrypt or decrypt data either on equipment or in a communications channel,
- delimitation or electoral boundary/district data, and
- user credentials (to determine how and which poll workers, tally centre workers or technical support staff can access specific machines or systems).

Given how essential an RMS is to the overall electoral process, it is appropriate to include rigorous testing of the system's security in an RMS test plan. This testing should go beyond the narrow 'technical' aspects of the security of the equipment, software and communications links. Instead, it is essential to take a holistic perspective that includes all the operational procedures, chain of custody (documentation of paper trail, etc.) and credential processes – because the human factor is the most important in security.

Effectively responding to the human factor requires strong and consistent internal oversight and monitoring. Electronic voting technologies and other aspects of an automated RMS shift the emphasis from external threats (voters or parties wishing to improperly manipulate the process) to internal threats (privileged insiders). An EMB therefore must pay particular attention to the recruitment and supervision of both its own staff and any contractors (including the manufacturers of equipment used).

The Council of Europe recommendations include a one-door, two-keys policy whereby "critical technical activities shall be carried out by teams of at least two people. The composition of the teams shall be regularly changed."[41]

This recommendation provides a vivid example of the higher security posture anticipated when electronic voting systems and, by association, fully automated results management systems are implemented. At the same time, though, the recommendation implies that such measures also contribute to increased costs.

41 Recommendation Rec(2004)11 of the Committee of Ministers to member states on legal, operational and technical standards for e-voting, paragraph 32. See https://wcd.coe.int/ViewDoc.jsp?id=778189.

4.5.7 Testing, code review and certification

The need for thorough testing of any electoral technology should be self-evident, but it is worth reiterating why tests must be done. First, whether systems were procured or developed in-house, testing is needed to determine if the systems execute the functions detailed in the requirements and that they do so accurately – in other words, that the outputs of the system are as expected. Secondly, testing helps ensure that systems perform in a reliable and robust manner. This includes (but is not limited to) such issues as capacity (whether systems can perform when under the full load of election day) and security (whether systems ensure that only authorized persons can use them and that those individuals in turn cannot abuse them).

Testing can be of the traditional sort, in which detailed test cases (instructions) are written to correspond to each and every requirement already documented for the system. Another sort is what is sometimes referred to as aggressive or adversarial testing – where attempts are made by authorized individuals (with or without detailed knowledge of the system) to penetrate, 'hack', improperly manipulate or otherwise identify and exploit vulnerabilities in the system. The results of all testing should be shared as needed to remove any vulnerabilities, to alter procedures or to otherwise strengthen systems.

In the case of an RMS, ballot papers from previous elections often have been used to test the overall system's accuracy. This approach is not without its problems, partly because of the need for different kinds of direct human participation and engagement. EMB staff or volunteers must ensure that these ballot papers are properly counted or that the precise voter choices are recorded.

A code review refers to when a person or team with appropriate skills and experience is given access to the source code of the system under review. Such reviews are often part of the software development process and employees of the solution manufacturer usually carry out the activity. Code reviews during acceptance testing may also be conducted by staff from an EMB itself or technical experts provided by development partners or from academia or other national institutions.

If a code review is to take place, the question of intellectual property arises. In brief, if the source code is proprietary (the property of the manufacturer) it may not be available for review, or perhaps those conducting the review are required to sign non-disclosure agreements (NDAs) in order to be given access to the code. No such NDAs are necessary if the code is open source. Also in regards to open source, members of the public may undertake code reviews and submit their findings, in addition to any experts specifically recruited to conduct such reviews. Indeed, there are precedents for inviting such scrutiny[42].

42 In Brazil, for example. See www.ndi.org/e-voting-guide/examples/source-code-review-brazil.

The relative merits of proprietary and open-source code are not examined in this document. An EMB can expect, however, that any public consultation on the implementation of electronic voting machines and both hybrid and fully automated RMS includes discussions on the subject.

Certification is a term used to describe a process by which it is established whether a system (or person) complies with certain standards. In the case of software development, for example, it may be required that the company from which the software was procured adheres to an international standard relating to software development[43].

Just as bus drivers or airplane pilots are not allowed or expected to self-certify, certification is generally conducted by third parties. If hybrid RMS models comprise relatively simple technologies, they are typically tested internally (often with stakeholder participation). When entire elections are conducted using electronic systems – and a fully automated RMS typically comprises one element of an end-to-end electronic voting (e-voting) system – EMBs often seek to have third-party certification prior to launch.

Code reviews and certification of highly sophisticated electronic voting systems and related automated RMS models are highly specialized tasks that are time-consuming and expensive. Those planning to introduce such systems into an electoral process should ensure that adequate time and resources are available for these activities.

According to some sources, the body responsible for certifying electronic voting machines in the United States, the Election Assistance Commission has around 44,000 employees[44]. Yet the certification task is so massive that the Commission actually licenses qualified laboratories to do the technical work of certifying systems. Elections Canada, in its report 'Establishing a Legal Framework for E-voting in Canada'[45], offers a concise overview of international standards and comprehensive reporting on the topic. It is clear from this report and experience worldwide that, in most countries and regions, there are no legal standards directly relevant to e-voting systems or related automated RMS models. The lack of standards is one reason that the certification of electronic voting and counting systems, and the automated RMS models they invariably incorporate, is as much a political as a technical exercise.

43 For example, CMM (Capability Maturity Model) or ISO/IEC 9126.

44 This Election Assistance Commission employment figure is from http://en.wikipedia.org/wiki/Election_Assistance_Commission.

45 Appendix A, available at www.elections.ca/content.aspx?section=res&dir=rec/tech/elfec&document=aa&lang=e.

There is a natural preference to procure solutions from companies whose products may be certified in other jurisdictions. This may provide comfort, but does not guarantee that the products will perform in the procurer's jurisdiction, especially if the legal and electoral environments differ significantly (for example, proportional representation versus first-past-the-post electoral systems).

4.5.8 Audit

The following is a definition of audit:

A planned and documented activity performed by qualified personnel to determine by investigation, examination, or evaluation of objective evidence, the adequacy and compliance with established procedures, or applicable documents, and the effectiveness of implementation.[46]

A key phrase in this definition is "established procedures, or applicable documents". A vendor of any electronic voting system and associated automated RSM model may propose and even offer draft procedures to an EMB that has purchased its systems. However, the EMB alone has responsibility for implementing and, through policy and management oversight, enforcing these procedures.

Where electronic voting systems include a VVPAT, the 'A' means audit – meaning that when casting a ballot each voter participates in an audit. Therefore, an EMB must put in place clear procedures to follow in the event that a voter reports an anomaly.

Characteristics of post-election audits may include:

- mandatory sample of all systems to be audited;
- the complete randomness of the sample;
- strict audit procedures, including chain of custody for all materials (whether paper or digital) to ensure consistency and reproducibility of audit results;
- timely completion of audits, to allow results to form the basis of electoral petitions or to have evidential value for hearings of such petitions; and
- special safeguards to protect the secrecy of the poll.

As mentioned earlier, the apparently contradictory requirements of transparency and confidentiality mean that the auditing of automated results management systems that are integral to comprehensive electronic voting systems is significantly different from the auditing of, for example, a bank's ATM system.

46 Auditor Dictionary, terms and definitions. See www.projectauditors.com/Dictionary2/1.8/index.php/term/,62555c9cae53606f68555ca75a.xhtml.

4.5.9 Advantages

Speed of availability of results

Fully automated results management means that both provisional and official results are available more quickly than in either manual or hybrid systems.

Reduction in opportunities for improper manipulation of results

Opportunities for tampering with results are significantly reduced, if not altogether eliminated.

An EMB can focus on anomalies

Following the close of polls, the resources of an EMB can be focused on recovering data from polling stations that have not yet transmitted or delivered results, as well as handling any anomalies or responding to complaints which arise.

Cost

Properly implemented (meaning competitively procured, and used over multiple electoral cycles), the automation of electoral systems can reduce costs.

4.5.10 Disadvantages

Cost

The procurement costs and infrastructural requirements for fully automated electoral information systems are significant. Remote villages may lack power and connectivity, and thus costly alternative technologies may be required (e.g., batteries, generators or solar power systems, or satellite communications).

Donor or vendor dependence and erosion of national ownership

The greater the sophistication of systems implemented and used, the higher the levels of technical expertise required. This can lead to vendor and donor dependence and erode real EMB and national ownership.

Complexity versus stakeholder capacity

The capacity of voters, political parties, media and civil society to fully understand complex electoral technologies is often limited. EMBs have to work much harder to consult, sensitize, inform and explain.

VVPATs reintroduce the human factor

The trend towards using VVPATs (voter-verified paper audit trails) has resulted in greater complexity and human operator involvement in automated systems. Where paper ballots are printed by e-voting systems, traditional (i.e., manual) counting of a sample or possibly all of these ballots may be necessary, thus diluting the principle of full automation.

Trust

An RMS generally contributes to an increase in stakeholder trust. Electronic voting technologies, by contrast, may be said to erode trust. An EMB that does not already enjoy significant trust of its stakeholders should consider carefully the impact of full automation.

Fraud mitigation changes, but does not disappear

With the use of a fully automated RMS, opportunities for improper manipulation of results at polling station or constituency or district tally centre level are significantly reduced. Yet there remains the potential vulnerability for tampering at systemic level by privileged insiders (employees or contractors of the EMB) or external players ('hackers'). Measures to counter these threats add significantly to cost.

4.5.11 CASE STUDY: FULLY AUTOMATED RMS MODEL (**VENEZUELA**)

INTRODUCTION

In terms of the use of technology across the spectrum of elections management, Venezuela has quietly caught up with and overtaken countries normally considered in the vanguard (Brazil and India) and can be considered a useful model for fully automated results management. See the referenced Carter Center report for greater detail on the Venezuelan RMS paradigm47.

There are lessons to be learnt from Venezuela for any EMB considering such solutions. A notable overarching lesson is that the necessary transparency and stakeholder engagement open such systems to scrutiny that inevitably identifies problems that need to be addressed if the technology is to enjoy widespread trust. And where technology serves to block one or more avenues for electoral manipulation and tampering, those seeking to manipulate or tamper shift attention to other possible entry points.

In Venezuela, each electronic voting machine (EVM) consists of a touch screen; a printer module (which functions to deliver a VVPAT); an activation switch connected to the EVM by a cable; and for some electoral events, an A3-sized touch-sensitive tablet on which a paper overlay with party names/logos is placed to assist voter selection. The EVMs can be powered from electricity infrastructure or, with the addition of an inverter, from a battery.

The focus of this case study is on the tabulation, audit and results processes. But it is necessary to describe another key technology used by the Venezuelan electoral authorities for the biometric authentication of voters as they enter polling stations on election day. The voter authentication system (known by its Spanish acronym, SIE) uses fingerprint scanning devices connected to laptop computers. For the 2013 presidential elections, some of the SIE devices were connected to central databases, thereby allowing real-time checking of voter fingerprints and storage of voters' attendance at a given polling station (thereby preventing multiple voting). Other SIEs were off-line devices that contained localised subsets of voter registration data. For those off-line devices, voter authentication data were transmitted to central servers later on or taken there in removable media.

47 The Carter Center. Developing a methodology for observing electronic voting. 2007. www.cartercenter.org.

STAKEHOLDER ENGAGEMENT AND BUILDING TRUST

Early attempts by the National Electoral Council (known by its Spanish acronym, CNE) to build trust with stakeholders regarding the electronic voting system varied in success. A European Union Election Observation Mission (EU-EOM) report from 2006 discussed activities being offered as 'audits' but comprising, at least initially, just presentations on the EVM and results aggregation systems. Many political parties did not participate and some of those that did lacked skilled personnel who could fully understand and evaluate what was taking place. The Carter Center's report from the 2005 recall referendum48 describes one activity as such: "Although the CNE presented this day as an audit, in reality it was only a simulation with very restricted access for the Coordinadora Democrática, Comando Maisanta [political parties] and observers. The observers were only allowed to watch the voting tests conducted by the operators." As stated elsewhere in this publication, sufficiently comprehensive auditing of systems, including results management systems, is a hugely complex and time-consuming task that requires high levels of technical human resource. For this reason, such auditing (and most certification) is outsourced to specialised agencies or companies.

In 2005, confidence-building measures were partially successful because they were conducted in a spirit of openness and cooperation.

Vulnerabilities discovered in 2005 were later addressed by CNE and its technology vendors. This is a vindication of the inclusive approach of the EMB and may be regarded as a model approach, provided sufficient time is allocated and meaningful access is allowed. The timeliness priority underscores a critical caveat: such activities should be conducted sufficiently in advance of any election to allow time for any problems that arise to be properly addressed by an EMB and its technology partner.

Although CNE and its partner has been relatively diligent in responding to problems, auditing remains a highly political endeavour at times. For example, a narrow majority separated the winning and losing candidate in the 2013 presidential elections. CNE conducted a post-election audit of no fewer than 54 percent of voting machines. Despite this, the losing candidate asked that the remaining 46 percent of EVMs also be audited. This request was not granted, leading to an appeal to the Supreme Court. The 2013 complaints notwithstanding, the transparency and accountability of the Venezuelan EVMs and RMS, coupled with the level of stakeholder engagement in pre-election audits, undoubtedly have been major factors in removing EVMs and the RMS

48 Available at www.cartercenter.org/news/publications/election_reports.html#venezuela.

from the political spotlight. The debate on whether or how Venezuelan elections are manipulated has shifted to such topics as voter registration, use of state resources, media access and a level playing field for campaigns.

The scope of the many pre-electoral and post-electoral audits and integrity mechanisms is substantial and includes the source codes of EVMs; the results aggregate on system; the biometric voter authentication machines; the software to randomly select polling staff; the lists of polling staff so selected; the tabulation reports from the EVMs; the reconciliation of VVPATs (paper ballots) with the electronic results; the use of voter registration log books with signatures and fingerprints of voters; and the use of electoral ink. A particularly important mechanism was the creation of encryption keys using a combination of characters from CNE, from the governing party and from the main opposition party. No one party or CNE has the entire encryption key, thereby enhancing confidence.

PRE-ELECTION PREPARATION OF EVMS AND VOTING PROCEDURES

At the EMB's headquarters in Caracas, all EVMs should have should have identical software installed.. A USB key, unique to each polling station, is created and configured separately and, once installed in a given 'blank' EVM, customizes that EVM to a particular polling station.

Just prior to voting, two reports are issued from each EVM. One is a diagnostics report while the second is a zero tally report, which demonstrates to operators, witnesses and others present that there are no votes in the machine. This is a digital version of demonstrating an empty ballot box to all present.

The EVMs, unlike many of the voter authentication machines, are not connected to any network during polling.

In the early elections conducted with EVMs, voters experienced problems casting their vote in a majority of polling stations observed by the European Union. In more recent elections, the use of EVMs has largely not been a problem as Venezuelans are more familiar with the technology and because the EMB improved its voter education processes.

TABULATION AND TRANSMISSION OF RESULTS

Once polling has ended at each location, the responsible official declares this fact and initiates a tallying process. The EVM prints out an original tally sheet that records the number of voters who have cast a vote on this machine and the results for each candidate (or party or referendum choice, as appropriate). In the majority of cases, the EVM is then connected to a network and results are transmitted in encrypted form, over virtual private network, to the results aggregation centre in Caracas. Thereafter, additional copies of the tally sheet are printed from the EVM and shared with the polling station staff and with up to six political party or candidate agents (with priority to those with the most votes).

After results have been transmitted, a significant number of EVMs, chosen by a random drawing of lots by polling station staff, are selected for auditing. The electronic results are then reconciled with the paper ballots for randomly selected audit EVMs in a given centre and any anomalies recorded on the tally sheet, which is then signed and sealed for transmission to CNE. Copies of the audit report are shared with some of those present.

It should be noted that there is a possibility of some discrepancies between the number of electronic ballots cast and the number of paper ballots. That is because the human factor dictates that some voters (deliberately or otherwise) fail to place paper receipts in the ballot box. The human factor also dictates that manual counting of ballot papers can introduce counting errors. While a shortfall (fewer paper ballots than electronic ballots) can be expected, there is also the remote possibility, particularly in multiple-EVM polling centres, of a ballot box containing more paper ballots than there electronic votes cast for that EVM. (That can be explained by voters placing paper ballots in the wrong ballot box.)

A balance must be struck between appropriate mechanisms to inhibit or discourage such mishandling of VVPATs in EVMs so equipped, while retaining the voter verification such functionality is designed to facilitate as well as protecting the secrecy of the ballot. The EU-EOM report on the 2006 Venezuelan elections mentions that these discrepancies, though occurring in 28 percent of polling stations observed, were of the order of one to five (ballots) and were "attributed to human error in the manual count".

No technical international observers (such as the European Union, Organization of American States [OAS] or The Carter Center) have covered elections since 2005. A 2012 publication issued by the Venezuelan Embassy to the United Kingdom describing the technical protections and audit mechanisms refers to 2006 reports from OAS and EU-EOM. That publication also refers to the substitution of election observation with electoral "accompaniment."49

The decline in substantive international observation has been compensated, in no small way, by the increased emphasis on citizen observation and participation by all stakeholders in all electoral processes. By 2012, The Carter Center was reporting that all parties were allowed to participate in a review of the voter registry. Parties were invited to participate in a comprehensive range of pre-election audit activities covering all systems being used for electronic authentication of voters, for electronic voting and for the transmission and tabulation of results. Even opposition parties were declaring their satisfaction with the security of the systems employed and the secrecy of the ballot. Such bipartisan consensus is fragile and requires ongoing transparency and proactivity on the part of the EMB. This is important because software is regularly updated to address bugs as well as add new functionality. When that happens, the new software must be subjected to the same comprehensive review and audit. Each electoral event requires the same level of scrutiny as previous elections.

49 The publication is available at embavenez.co.uk/pdf/cne/cne3.pdf.

Exit polls, parallel vote tabulation, quick counts and official results

Ballots Brought to Sudan's Elections High Committee for Verification
UN Photo/Tim McKulka

Election results can be either official or non-official. EMBs are in charge of official election results, while non-official results are delivered by different stakeholders. These may include the media, political parties and national and international observer groups. Non-official election results can be obtained through the use of different methodologies. These can be, in chronological order of release, exit polls, quick counts and parallel vote tabulation (PVT). All of these are non-official and their use depends on the actor(s) implementing.

Exit polls are done mainly by the media to obtain early indications as to what elections results might be. They are approximations of reality as voters are asked when leaving polling stations how they voted (e.g., for which candidate or party, or what they selected from referendum questions). It is impossible to verify such polls. The number of voters interviewed and the extent of polling influence the accuracy of the results (when compared later with official ones).

Quick counts are usually implemented by observer groups and political parties[50]. In transitional and post-conflict environments, such an approach may be more suitable and reliable than exit polls. Observers may use the data to help ensure that the results that are released are accurate. Political parties and candidates also use quick counts to quickly obtain information from which to project results – to help determine if they have won (or are likely to win). In some cases, an EMB may compare quick count results with its own provisional results, an approach that may allow it to gauge confidence in the RMS..

Two main issues have to be managed to conduct a quick count properly. The first relates to the need to select a representative sample of polling stations throughout the country with the deployment of observers and the logistics involved with it. The second relates to the number of polling stations needed for the sample to provide information within an acceptable error margin. Taking these two factors into account, quick counts are best suited for national-level elections, although they can also be implemented usefully for smaller constituencies in special circumstances. Ideally, quick counts are undertaken with the knowledge of an EMB in order to be used as a tool to help prevent potential fraud.

50 See www.ndi.org/node/12993 for a detailed description of quick count.

Parallel vote tabulation (PVT) requires a considerable amount of human resources, far more than quick counts, to be useful. In principle, for comprehensive PVT the implementing body needs to have people assigned to collect information from all polling stations. With such a body of information, political parties and observer groups can verify aggregated or disaggregated results released by an EMB. Partial PVT may also take place, but the validity of such partial efforts is reduced to verifying the specific results from the polling stations were results have been obtained.

One issue with PVT is always the legal validity of results obtained at polling stations. When PVT results differ from official results, courts may require official documents to accept a challenge to the official results. In such instances, certified copies are requested from the EMB of results at polling station level to ensure political parties that they will be able to use that information however they find it useful.

It has to be recalled that provisional results often vary after the verification of results by an EMB. Reasons may include counting errors on results sheets and the impact of complaints accepted by the EMB or courts. (And moreover, investigation of complaints may produce results different from those obtained through quick counts or PVT.)

As an innovative initiative, political parties in some countries have agreed to collaborate and coordinate efforts in regards to non-official results In Ghana recently, for example, parties entered an agreement to share the information received via phone from their representatives in an arrangement called the Joint Party Elections Results Monitoring Project (J-PERM).

This arrangement has enabled them to (1) gather more data from polling stations with representatives of any party and (2) compare data among parties to assess if all information was identical. In cases of discrepancies since J-PERM was initiated, the parties have jointly discussed and analysed the reasons for the differences and agreed on provisional results with the help of an impartial mediator. The approach has limited the parties' desire or need to look for legal remedies.

Table 4 provides a schematic diagram of the different types of results that may be prepared and released during electoral processes, as well as important factors associated with each type.

Table 4. *Type of results and related issues*

Results type	Source	Coverage	Accuracy	Resources needed
Provisional	EMB	Partial or complete	Some minor discrepancies possible	High
Preliminary	EMB	Partial or complete	Complete	High
Final	EMB or courts	Partial or complete	Complete	High
Quick count	Observers, EMB, political parties, others	Partial, maximum 5% of polling stations	Error margin below 5% envisaged	Low
Exit poll	Media, observers, others	Partial	Uncertain, depends on methodology and coverage	Low
Parallel vote tabulation (PVT)	Observers, political parties, others	Complete for information provided	Complete for the information provided	Medium

Regardless of the RMS model adopted, some aspects have to be considered in every case to facilitate implementation. Some of the main ones are discussed below in a series of recommendations.

Overall recommendations

Polling Station for Sudan Elections Installed in North Darfur IDP Camp
UN Photo/Albert González Farran

6.1 The political environment should guide technical decisions

With electoral processes, administrators are expected to pay substantial attention to the technical complexities. However, particularly in transitional and post-conflict contexts, due attention also needs to be given to the political environment. This is especially true for the aggregation period, which is often when tensions are at their highest. It is important to always consider the risks to the political process from a failed or turbulent results process. As seen in the Kenyan election 2007 elections, even when a country is thought to be stable, a failed results process can lead to tragedy.

6.2 Allow sufficient time for planning and implementation

The decision on which RMS model to be used should be taken early on in the process to allow sufficient time to (1) procure equipment and materials; (2) identify, recruit and train staff; and (3) test equipment thoroughly. A decision on the use of a fully automated RMS model should ideally be made at least 18 months before election day. Comparable lead times for a hybrid model with some ICTs and a fully manual model are 12 months and six months, respectively. Also of note is the need to allocate sufficient time for all actors and relevant stakeholders to come to a consensus on the model to be used.

6.3 Use the most recently used RMS model as a baseline

The RMS model used for the most recent elections should be taken as the starting point, with all recommendations emanating from the post-elections lessons learnt exercises considered in regards to a new design. Then, a checklist should be used to assess the current status of the various elements[51] that should affect and influence the RMS model to be used. Once these steps are taken, initial options should be put on the table for discussions involving the EMB and stakeholders.

6.4 Involve stakeholders early on in the process

Representatives from all stakeholders – political parties, candidates, civil society groups, media, international partners, etc. – should be involved at an early stage when various options are on the table and their respective advantages and disadvantages are being assessed by the EMB. The ideal scenario for the implementation of an acceptable and successful RMS is when all stakeholders agree with the EMB on the model to be used. Achieving agreement may take far more time than an EMB might anticipate, and may depend on the level of depth of previously created trust among the parties.

51 Section 3 of this publication includes detailed discussion of key issues.

6.5 Start slow with the introduction of new technologies

New technologies may seem to be a panacea to solve all problems related to an RMS. However, many new and often unforeseen issues may surface with ICTs that have to be managed properly to avoid simply exchanging some problems for others. Regardless of the RMS model used, there are always challenges to the credibility of this phase of the electoral process; moreover, questions are typically raised as to why new technologies should be introduced in the first place.

New technologies therefore should be introduced slowly and analysed as to their impact on the overall electoral process, especially with regard to acceptance by stakeholders. By-elections and referendums offer excellent opportunities for piloting new RMS models: by-elections, because of their limited scale, and referendums because of the relative simplicity of the ballot. New technologies have to be introduced not only when it is possible, but also when the timing and options are acceptable to stakeholders.

6.6 Benefit from other EMBs' experience

Many EMBs have undergone the process of moving from one RMS model to another. It is likely to be beneficial to research and learn from the accumulative experience of EMBs to avoid making the same mistakes and to identify best practices. No EMB operates in a vacuum and EMBs can support each other in this endeavour as in many others. Regional and international transfer of experience is helpful to all partners involved.

Annexes

Woman in Juba, Sudan, Votes in Extended Elections
UN Photo/Tim McKulka

Annex 1. Haiti polling station results form

A. Full description of the polling station from which the form came – including codes and names (to rule out confusion)

B. The names of the polling station officials in attendance

C. The number of ballot papers received for each contest. Also, space to list any missing electoral materials

D. Polling station opening time and date

E. List of political party and candidate agents and any citizen or international observers

F. Polling station closing time

G. Ballot paper reconciliation (number of ballots in each box).

H. The number of votes cast for each candidate (Senate)

I. The number of votes cast for each candidate (Parliament)

J. Other categories of ballot paper (null, blank, 'gate', 'pa sevi')

K. Name and signature of all polling officials present

L. Name and signature of political party and candidate agents and citizen or international observers. This section includes space to detail why anyone refused to sign.

M. These forms were in quintuplicate, non-carbon copy (also known as NCR) with each sheet having a different colour. This section of the form reminded polling officials where each copy was to be sent – to the vote tabulation centre at the EMB headquarters; to the polling station; to the Departmental Electoral Office (known by its French acronym, BED) and the Communal Electoral Office (known by its French acronym, BEK); to political or candidate agents if they request them

Commentary

Some of the sections of this results form might reasonably be omitted (for example the part of Section C that lists missing electoral materials), but most are essential – in particular the complete details of all ballot papers, in order to facilitate reconciliation. Potentially important data missing from this form are the number of registered voters at this polling station.

For the second round elections in Haiti in 2006, these results forms were pre-printed – that is, they included all the information available prior to the elections (the polling station code and names in Section A, the candidate names for Sections H and I). This reduced errors both in form completion and at the data entry stage at the vote tabulation centre at the national level. As mentioned previously in this publication, pre-printed forms have the disadvantage that great care must be taken to deliver the correct form to each polling station.

Annex 2. Check list: results management system

Issue	Status			Improvement possible	
	Low	Medium	High	Yes	No
Legal issues					
Cultural considerations					
Transparency issue					
Credibility issues					
Complaints adjudication					
Stakeholders expectations					
Level of elections					
Use of technology					
Costs					
Risks					
Infrastructure available					
Security requirements					
Sustainability					
Capacity of EMB (institutional, organizational, individual)					
Time before elections					

This checklist could be a guiding tool during the drafting of a concept note to select an RMS. Once it has been filled in with all relevant information, and considering the most recently used RMS model as a baseline, initial indications are likely to become apparent as to which RMS models might be put in place in time for the next elections and which should be avoided. The option to apply a possible advanced model through a pilot phase should also be kept in mind.

Annex 3. Sample for the RMS component of an operations plan: RMS manual model

Legend for table:

CEO = Chief electoral officer
DO = District officer
EMB = Electoral management body
FIN = Finance
HC = High court
HR/TRA = Human resources/training
OPS = Operations
PC = Polling centre
PRO = Procurement

		Responsible	Start date	End date
	RESULTS MANAGEMENT		01/06/10	31/12/10
1	Establish results management procedures	IEC	01/06/10	15/06/10
1.1.	Evaluate and improve past results management arrangements	CEO	01/06/10	10/6/10
1.2.	Draw information flow chart from polling stations to IEC (the EMB) headquarters	OPS	11/06/10	15/06/10
2	Operationalize districts and national tabulation centres	OPS	1/08/10	20/11/10
2.1.	Establish staff and material needs	OPS	1/08/10	15/08/10
2.2.	Procure materials and equipment	PRO	1/09/10	1/09/10
2.3.	Recruit and train staff	HR/TRA	1/11/10	20/11/10
2.4.	Assure payment modalities	FIN	20/11/10	20/11/10
3	All staff, material and equipment in place	OPS	2/11/10	2/11/10
4	Test run on count	OPS	20/11/10	20/11/10
4.1.	Evaluation of test run	OPS	20/11/10	20/11/10

		Responsible	Start date	End date
	RESULTS MANAGEMENT			
5	Count commences (18:00 hours)	OPS	3/12/10	3/12/10
6	Posting of provisional results at polling centre	PC	13/12/10	3/12/10
7	Transmission of documentation from polling centres to district centres	PC	13/12/10	5/12/10
8	Tabulation	CEO	3/12/10	7/12/10
8.1.	Tabulation commences at district centres	DO	3/12/10	3/12/10
8.2.	Tabulation finishes at district centres	DO	7/12/10	7/12/10
8.3.	Announcement of results at district level	DO	7/12/10	7/12/10
8.4.	Transmission of copies of polling station results and tabulation to IEC headquarters	DO	3/12/10	7/12/10
8.5.	Tabulation of polling station results at IEC headquarters	OPS	3/12/10	7/12/10
8.6.	Announcement of preliminary results	IEC	3/12/10	7/12/10
9	Complaints to be forwarded to IEC	IEC	4/12/10	7/12/10
10	Decision by IEC on complaints	IEC	7/12/10	7/12/10
11	Announcement of national results by IEC	IEC	8/12/10	8/12/10
12	Appeal to the high court on IEC decision	HC	9/12/10	15/12/10
13	Decision of high court of appeals	HC	30/12/10	30/12/10
14	Announcement of final results	IEC	31/12/10	31/12/10

Annex 4. Option aggregation/verification of results flowchart

Annex 5. Arab States electoral quick guide[52]

Legend for table:

BV	Block vote
CDI	Conflict Dynamics International
EDR	Electoral dispute resolution
EISA	Electoral Institute for Sustainable Democracy in Africa
EMB	Electoral management body
ERIS/DRI	Electoral Reform International Society/Democracy Reporting International
FPTP	First-past-the-post
IFES	International Foundation for Electoral Systems
NDI	National Democratic Institute
PBV	Party block vote
PR	Proportional representation
SNTV	Single non-transferable vote
TRS	Two-round system
UNDP	United Nations Development Programme
UNOPS	United Nations Office for Project Services
USAID	United Stated Agency for International Development

52 This annex aims to provide a basic overview of how results management systems used in some regions and their relation to other aspects of the electoral process. The Arab Region was chosen because numerous changes have been taking place in the past years with regard to this component of electoral processes.

COUNTRY	RMS USED	ELECTORAL SYSTEM	EDR	EMB	INTERNATIONAL PARTNERS
Djibouti	Manual	President: TRS Parliament: parallel system (PBV and PR)	Judiciary	Independent	USAID
Egypt	Manual	President: TRS Note: Currently in discussion, leaning towards a mixed system (list PR and majoritarian)	Judiciary	Judiciary Ministry of Interior	UNDP IFES
Iraq	Hybrid	Parliament: PR open party lists	EMB Judiciary	Independent	UNDP UNOPS IFES
Jordan	Hybrid	Lower House: parallel (FPTP/SNTV and PR closed list) Upper House: appointed by the king	EMB Judiciary	Independent	UNDP IFES
Lebanon	Manual	Parliament: elected by FPTP and BV	Judiciary	Ministry of Interior and Supervisory Election Commission	UNDP
Libya	Hybrid	Parallel system: PR closed list and FPTP/SNTV	EMB Judiciary	Independent	UN UNDP IFES
Palestine	Manual	President: TRS Parallel system: PR closed party list and BV	EMB Judiciary	Independent	EC UNDP Norway

COUNTRY	RMS USED	ELECTORAL SYSTEM	EDR	EMB	INTERNATIONAL PARTNERS
Somalia	NA	NA	NA	Independent	UNDP EISA CDI NDI
Sudan	Hybrid	National Assembly and state assemblies: parallel (FPTP and PR closed party and women lists) Council of States: indirect BV President: TRS Governors: FPTP	Judiciary	Independent	International Office for Migration (IOM)
Tunisia	Manual	National Assembly: PR closed list	EMB Judiciary	Independent Government	IFES UNDP NDI International Republican Institute (IRI)
Yemen	Manual	President: TRS House of Representatives: FPTP Consultative Council: appointed by President	EMB Judiciary	Independent	UNDP IFES ERIS/DRI NDI

Annex 6. References and resources

- **Online Training Course**
  EU-UNDP Joint Task Force on Electoral Assistance has an online course (it can also be downloaded for offline study) on ICTs and elections management. It is only six hours long and well worth the time.
  http://elearning.ec-undp-electoralassistance.org/

- **EU-UNDP Joint Task Force (JTF)**
  In March 2012, the EU and UNDP conducted a Thematic Workshop on ICTs and Elections. The summary report and all of the presentations made at this five-day event are available for download at JTF's website (by following the links Knowledge, Trainings, Mombasa 2012).
  www.ec-undp-electoralassistance.org/

- **Elections Canada**
  An overview of international standards and reports relating to electronic voting systems.
  www.elections.ca/content.aspx?section=res&dir=rec/tech/elfec&document=aa&lang=e

- **Council of Europe**
  Recommendation Rec(2004)11 of the Committee of Ministers to member states on legal, operational and technical standards for e-voting.
  https://wcd.coe.int/ViewDoc.jsp?id=778189

- **U.S. Election Assistance Commission (EAC)**
  The agency that regulates certification of electronic voting systems in the United States. While its website is focused on the particular electoral landscape of the United States, EAC's comprehensive approach to testing and certification of such systems offers much to ponder beyond that country.
  www.eac.gov/testing_and_certification/default.aspx

- **Principles and best practices for post-election audits**
  Though focused on the U.S. electoral paradigm, this site offers advice that has global relevance.
  http://electionaudits.org/principles.html

- **NDI and IFES (National Democracy Institute and International Foundation for Electoral Systems)**
  This joint publication offers detailed insights into the introduction of electronic voting and counting technologies.
  www.ndi.org/implementing-and-overseeing-e-voting-counting-technologies

- **OSCE/ODIHR (Organization for Security and Co-operation in Europe/ Office for Democratic Institutions and Human Rights)**
  Handbook for the observation of new voting technologies.
  Though aimed at observers, this guide offers valuable insights into the introduction of new voting technologies and is recommended for anyone working in an EMB or any institution offering technical assistance to an EMB.
  www.osce.org/odihr/elections/104939

- **Chris Karlof, Naveen Sastry, David Wagner. Cryptographic voting protocols: a systems perspective. Proceedings of the Fourteenth USENIX Security Symposium (USENIX Security 2005), 33-50, August 2005.**
  www.usenix.org/legacy/event/sec05/tech/full_papers/karlof/karlof.pdf

- **ACE Electoral Knowledge Project. ACE encyclopaedia: results management systems. 2014**
  www.aceproject.org

- **EU and UNDP. Handbook on technology and electoral registration. 2012**
  www.propalop-tl.org
- **European Commission (EC). EC methodological guide on electoral assistance. 2006**

- **IFES. Electronic voting and counting technologies: a guide to conducting feasibility studies. 2011**

- **The Carter Center. Developing a methodology for observing electronic voting. 2007** www.cartercenter.org

- **Consejo Nacional Electoral (CNE). 2006 manual** www.cne.gov.ve/elecciones/presidencial2006/documentos/ManualPresidencial2006.zip