Organization of American States

Electoral Technology in the Americas: Five Case Studies

General Secretariat of the Organization of American States (GS/OAS)

José Miguel Insulza
Secretary General

Albert R. Ramdin
Assistant Secretary General

Víctor Rico Frontaura
Secretary of Political Affairs

Pablo Gutiérrez
Director
Department of Electoral Cooperation and Observation

Organization of American States

Electoral Technology in the Americas: Five Case Studies

Table of Contents

1. Introduction

Over the past few years, the Organization of American States (OAS) has accumulated skill, knowledge, and a growing recognition in the field of elections. From the time it first began to work in this area in 1962 until now, the General Secretariat observed some 160 elections in more than 28 countries. This effort has been a continual learning process that has enabled the OAS to gradually strengthen its observation practices over the years.

The mission of the OAS Department of Electoral Cooperation and Observation (DECO) is to help consolidate political-electoral systems and support democratic elections in the countries of the Americas. To that effect, it is imperative to continue strengthening its electoral observation work so that it becomes a permanent operation that is professional and well-grounded, especially considering the level of recognition an international observation process receives when backed by an organization such as the OAS.

The use of technology, including electoral technology, is critical for the OAS Member States. In the Plan of Action adopted in 2001 by the Third Summit of the Americas, the region's Heads of State and Government affirm that they will "continue to enhance electoral mechanisms, using information and communications technologies where possible, to effectively guarantee the impartiality, promptness and independent action of agencies, tribunals or other bodies responsible for the conduct, supervision and verification of elections at national and sub-national levels." Meanwhile, in the 2006 Declaration of Santo Domingo, entitled "Good Governance and Development in the Knowledge-Based Society," the OAS member states recognize that technology is an important tool with which the countries can modernize their institutions, increase efficiency in the management and delivery of services in the public sector, ensure accountability, and in general terms, strengthen democratic governance.

The consensus about the usefulness of this type of technology in the electoral process is also reflected in various resolutions of the OAS General Assembly, such as in AG/RES. 2428 (XXXVIII-O/08), "Modernization and Use of Electoral Technologies in the Hemisphere," adopted during the fourth plenary session of the General Assembly, held on June 3, 2008, in Medellin, Colombia. In this resolution, the OAS member states underscore, among other things, efforts made by election officials in the countries to organize and administer elections in a way that increases the quality and transparency of the electoral process, including the incorporation of new electoral technology. They also urge the General Secretariat, through its Secretariat for Political Affairs' Department for Electoral Cooperation and Observation, to support Member States, at their request, so that their electoral bodies can join in a horizontal cooperation effort to adopt new electoral technologies, under the auspices of the OAS.

It is vital to work towards strengthening the electoral management bodies of the region so that the application of technologies does not generate resistance from citizens. At the same time, it is necessary to keep the electorate informed to engender trust in the use of technology as a means to improve some aspects of the electoral process and not as an end in itself. Along these lines, it is important to open up opportunities for the exchange of experiences and knowledge that can encourage the development of technology tools tailored to specific national needs. The

initiative to compile case studies and best practices in how technology is used in the organization of elections is one of the objectives included in the strategic plan developed by the OAS/DECO.

This publication seeks to provide updated, systematized information that can help identify practices for designing, incorporating, and applying new technology in the electoral context. For purposes of this report, case studies were done on five OAS Member States: Chile, Costa Rica, Jamaica, Mexico, and Peru. Each takes a different approach to the use of technology for different aspects and at different points in the electoral process, and each has valuable experiences to share.

2. Information and Communications Technologies (ICTs)

Information and Communications Technologies (ICT) are the collection of technologies that allow information to be acquired, produced, stored, processed, communicated, recorded, and presented in the form of voice, images, or data contained in signals that are acoustic, optical, or electromagnetic in nature[1]. Electronics is the technology that underlies and supports the development of telecommunications, computing, and audiovisual technologies.

This includes all information systems—not just computers, but also telecommunications networks, telematics, cellular telephones, televisions, radios, digital newspapers, faxes, portable devices, etc. All these firsthand electronic tools help to shape people's lives today.

The principal features of ICTs are the following:

Immateriality. ICTs convert information, which traditionally has been subject to a physical medium, into something that does not consist of matter. The digitization process makes it possible to store massive quantities of information on small physical devices (disks, CDs, USB memory sticks, etc.). Meanwhile, users can access information located on remote electronic devices; the information is transmitted invisibly and intangibly via communication networks.

Immediacy. Information can be transmitted instantaneously to places that are physically far away, through "information highways." Terms such as cyberspace have been coined to define the virtual, non-real space in which information is placed (as opposed to the physical features of the object used for its storage), adding to the sense of immediacy and intangibility.

Multimedia Applications. Multimedia applications or programs have been developed as a user-friendly, simple communications interface that makes ICTs more accessible to all users. One of the most important features in these environments—possibly the most important—is "interactivity." Unlike more classic technologies (TV and radio) that allow a one-way flow from a broadcaster to a mass of passive spectators, using a computer that is interconnected via digital communication networks provides for two-way, person-to-person or person-to-group interaction.

To summarize, the new Information and Communications Technologies are those computer-related and information technology tools that process, store, synthesize, recover, and present information in a wide variety of forms. ICTs consist of a whole set of tools, media, and channels used for shaping, recording, storing, and disseminating information.

In all types of applications, ICTs are a means and not an end; that is, they are tools that make it easier to receive, store, and communicate information. While it is true that the need to communicate underscores the importance of being knowledgeable about information and communications technologies and their application in different areas of life, it is also necessary to recognize the repercussions, whether beneficial or harmful, that come from using these new technologies.

ICT applications can be found in a multitude of aspects of daily life; in fact, it is hard to find any activity in which some aspect of these technologies does not appear in one form or the other. As a result, the development of ICTs in the last few years has been dramatic, both in terms

---

[1]   Group of Information Technology and Communication: www.gtic.ssr.upm.es

of technological advances and the availability of new services.

The impact of ICTs on the electoral process is seen mainly through the development of information systems and information processing. Key areas that have to do with elections include matters related to processing, organizing, presenting, and accessing any type of information or data in any multimedia format (voice, data, images, graphics, etc.); systems designed for interactivity and consolidation; Geographic Information Systems (GIS); and the management of massive amounts of data.

Two extremely important aspects to keep in mind when information technologies are introduced into the electoral process are the risks that stem from their use and the need for backup systems to ensure continuity of the process. These are primary considerations regardless of whether a particular level of technology is used or not. To minimize risks in the use of technologies, electoral bodies and other political actors involved in the process usually take the following steps, among others:

- Ensure that the technology is physically secure, to prevent accidental damage or unauthorized access.
- Protect computer software programs and information to guarantee security, preventing unauthorized access and taking measures to safeguard against viruses.
- Ensure that information is gathered in a reliable way, incorporating solid methodologies for information capture, providing adequate staff training, and applying techniques for information verification.
- Guarantee that the information is available, systematically backing it up and having manual contingency systems on hand.
- Apply systems for verification and testing, as well as, maintenance routines to make sure the equipment, communications, and computer programs can operate effectively.
- Have insurance policies in place against monetary or material losses.
- Have performance safeguards in place, such as bonuses or disciplinary clauses, to ensure that staff and outside providers have a direct interest in the project's successful conclusion.

- Encode information, Internet sites, and computer equipment codes to guarantee that unauthorized users cannot access the system.
- Adopt protection measures to be able to assure users and other interested parties that the technology is reliable.
- Adopt and comply with privacy policies to make sure that personnel and information remain secure while at the same time ensuring that relevant public information is available.

Contingency measures to be considered in an electoral process may include the following:

- Have desktop or laptop computers available with backup information to protect against possible network failures.
- Use paper electoral ballots if the voting system fails.
- Hand-count ballots if the mechanical or electronic system fails.
- Use paper and manual calculators for the vote count if the automated spreadsheets or vote-counting systems fail.
- Use manual formats to replace information captured on screen if computers crash (so that activity can continue while the system is down). The information can be incorporated into the system once it is back online.
- Create mirror systems in backup equipment, which in turn have backup programs, in case the main system fails.
- Ensure that alternate energy supplies are available in case the grid goes down.
- Use fax machines, telephones, or messenger services to transmit results if the online systems fail.
- Distribute election results or other types of information in printed form if the systems to display information online fail.
- Ensure the availability of speakers and equipment to present results "live," in case the results cannot be presented electronically.
- Have backup equipment available that could be put into operation at a moment's notice.

In light of the growing implementation of these types of technologies in various processes related to organizing elections, the most important aspect to keep in mind in each step of a highly automated election is oversight.

Auditing processes should be carried out by the principal actors in contention, mainly the political parties, as well as civil organizations and the internal audits done by the electoral body itself.

Following are five case studies of countries that have incorporated information and communications technologies into the electoral process.

Case Studies

3.1. Chile

3.1.1 Background

In October 1986, Chile enacted Law No. 18556, the Organic Constitutional Law on the Electoral Registration System and Electoral Service. This was one of the laws implementing the provisions of Article 18 of the Political Constitution of the Republic of Chile, which creates a public electoral system whose organization and functioning is established through organic constitutional laws.

The Chilean election system enjoys a high level of confidence among political parties and civil society in general.[2] This confidence is based on the prestige of the country's electoral institutions: the Electoral Service (SERVEL), the Ministry of the Interior (MININT), and the Elections Qualifying Court (TRICEL).

While the use of technology is booming in Chile, seen in everything from intra-ministerial communications to sophisticated satellite-based public security systems, the organization and development of its electoral process is done by hand. Perhaps this is the most interesting aspect of the Chilean electoral process, since it shows that the credibility and legitimacy of an electoral process goes beyond the use of the latest technologies.

The credibility of the Chilean electoral process is based on the confidence and transparency afforded by its electoral institutions. Moreover, the process includes mechanisms for oversight between institutions, which helps to guarantee and protect the integrity of elections.

In recent years, the Chilean electoral system has undergone a series of reforms; these include conducting run-off elections and the holding of two separate elections for local authorities (one to elect mayors and the other for members of city councils), each with a different election system. As of this writing, various political sectors are demanding that the country's binomial system for the election of congressional representatives be changed to a proportional system. Should this change take place, the Ministry of the Interior's system for the communication and transmission of preliminary results is sufficiently flexible that it would be able to quickly meet new challenges.

While transparency and accountability of public institutions is part of the new era of modernization of state entities, the electoral institutions have made adjustments to comply with such controls and demonstrate transparency in management. This has given the system continued credibility. The electorate, having seen that the organization of the electoral process does not present significant problems in and of itself, does not find the need to change it. Instead, discussions about the electoral system tend to focus on structural changes, including the effectiveness of the binomial system or the automatic voter registration system.

The technological changes that have been implemented in the electoral process, basically in the Preliminary Election Results Transmission System (TREP, for its acronym in Spanish) and the official computation system, have been made in the context of programs for development and modernization of public management in Chile. These programs started in 1999 with the creation, via Decree No. 5996, of the Internal Network for State Connectivity and Communication, or State Intranet.

The main purpose of this regulation was to create a communications structure for state institutions that would allow public services to be delivered effectively and efficiently.

---

[2]   Latinobarómetro data.

Thus, during the 2000 municipal elections a data transmission test was conducted using the State Intranet. This internal network was designed within a Metropolitan Area Network (MAN). It connects the heads of the Wide Area Networks (WANs) in the government ministries that have them, as well as their Local Area Networks (LANs). It was also connected to the Internet through three providers, one of which was the Network Access Point (NAP).

As a result of the successful test conducted during the 2000 elections, Supreme Decree No. 1299 was issued in December 2004, establishing new regulations for the Intranet network. It also established that, as part of its informational role during electoral periods, the Ministry of the Interior should implement a modern, advanced, nationwide internal communications network, which would be developed by the Ministry's Information Division.

3.1.2 Institutional Framework

Law No. 18556, the Organic Constitutional Law on the Electoral Registration System and Electoral Service, established the Electoral Service within the Ministry of the Interior. Its Director is appointed by the President with the majority approval of the Senate, and can be removed in the same manner. The SERVEL is an autonomous body responsible for organizing, auditing, and monitoring every electoral process established by the Constitution and by law. It is also responsible for preparing and maintaining the electoral registry of citizens who are eligible to exercise their franchise, as well as for creating and maintaining an alphabetical registry of those who have had their right to vote suspended and those who have lost their citizenship status.[3] The Electoral Service is also in charge of designing and printing books, forms, and other documents used in the process of electoral registration, as well as identity documents and election supplies.

It is also responsible for maintaining the registration system for political parties and affiliates, and for carrying out other duties and functions specified under the Organic Constitutional Law of Political Parties.

The administrative authorities responsible for the voter registry are as follows:

- **Election Boards.** These are established in the capital of each province and are composed of the respective judicial auditor of the Court of Appeals, the public defender of the provincial capital, and the real estate conservator. The Election Boards' principal duties are to designate members of the Registration Boards and the places where they will operate, based on recommendations made by mayors.
- **Registration Boards.** One of these is established in each municipality, and it is to this entity that citizens go to become registered. The three members of each Registration Board are appointed by the Election Boards.

The Ministry of the Interior is responsible for controlling the electronic communication of election data, as well as, its display and dissemination. It is in charge of the preliminary election results system in Chilean elections. The MININT is also responsible for determining the technological procedures, requirements, and standards for joining this network. These regulations cover the preliminary transmission of election results as well as electoral consultations.

The Elections Qualifying Court—the highest court for election matters—has functioned continuously since it was reestablished in 1987. The TRICEL is a special jurisdictional body that considers matters related to the general vote count and the qualification of elections for president, members of the national Congress, and local authorities (mayors and council members); resolves any claims that may arise; and proclaims election winners. Previously, in the case of the first two types of elections, that task fell to each legislative chamber, and the full Congress proclaimed the winner for president.

Since the 2005 constitutional reform, the TRICEL has been composed of five members (with four-year terms), four of whom are ministers of the Supreme Court of Justice,

---

[3] Citizenship status can be lost through the loss of Chilean nationality, conviction of a felony, or conviction for crimes classified under law as terrorist acts (Art. 17 of the Political Constitution of the Republic of Chile).

appointed by that body through random selection. The other member is a citizen who is required to have occupied the post of president or vice president of the Chamber of Deputies or the Senate (serving for at least 365 days), who is also appointed by the Supreme Court of Justice.

For its part, Article 85 of the Political Constitution of Chile establishes that the electoral justice system is made up of Regional Electoral Courts, which are responsible for qualifying elections held by professional associations and those prescribed by the Constitution. These courts are composed of three members, one of whom must be a minister of the respective Court of Appeals and the other two appointed by the TRICEL (also with a four-year mandate). The TRICEL is responsible for resolving appeals of decisions by the Regional Electoral Courts.

3.1.3 Legal Framework

Law No. 18556, the Organic Constitutional Law on the Electoral Registration System and Electoral Service, governs the functioning of the SERVEL. There is also a series of Organic Constitutional Laws that regulate the rest of the electoral system and play a role in the Electoral Service's operation. These are:

- Law No. 18460 on the Elections Qualifying Court.
- Law. No. 18593 on the Regional Electoral Courts.
- Law No. 18603 on Political Parties.
- Law No. 18695 on Municipalities.
- Law No. 18700 on Popular Elections and Vote Counts.
- Law No. 19175 on Regional Government and Administration.

In terms of existing regulations regarding the use of electoral technology, Organic Constitutional Law No. 18556 on the Electoral Registration System and Electoral Service establishes that the voter list for each election must be computerized and arranged in an alphabetical list of persons who are eligible to vote.

Meanwhile, as a result of state modernization policies adopted in September 1999 through Supreme Decree No. 5996, the Chilean government established that all public institutions must be interconnected through the State Intranet. The purpose was to have a data network that could serve and inform citizens; facilitate communication among public ministries and services through a secure, reliable network; reduce costs; and progressively improve citizens' participation in and access to government via the Internet.

To implement this regulation, Supreme Decree No. 1299 was issued in 2004. Under this decree, the Ministry of the Interior, in order to carry out its regular functions as well as its periodic informational role with respect to any election held in the country, implemented an internal, nationwide communications network using modern advanced technology. The network was developed and is run by the Ministry's Information Division, with the idea that it would be used to the benefit of other state bodies.

3.1.4 Electoral Process

The electoral process in Chile, to a large degree, is carried out manually. In each election there are approximately 35,000 polling stations in operation; these are distributed across some 1,500 voting sites.

Voter Registration

Voter identification is based on the single national identity document, which contains a unique, unrepeated identification number (called a Rol Único Nacional, or RUN). This task is the responsibility of the National Civil Registry and Identification Service.

Electoral registration, which is necessary to be able to exercise the right to vote, is voluntary, personal, free of charge, public, and formal. A person interested in registering must do so with the Registration Board that corresponds to his or her home address. The person must meet the requirements for citizenship established by the Constitution.[4] The identity and age of the interested party are established by means of the person's valid national

---

[4]   Chileans who have turned 18 years of age and who have not been convicted of a felony are citizens (Article 13 of the Political Constitution of the Republic of Chile). Foreigners who have lived in Chile for more than five years and who meet the requirements indicated in the first paragraph of Article 13 may exercise the right to vote in those cases and in such forms as determined under the law (Article 14 of the Political Constitution of the Republic of Chile).

identity document, or the identification document provided to foreigners, issued by the Civil Registry and Identification Service. The new citizen will receive a voting card, which will include the name of the electoral district in which he or she is registered and the corresponding registration and polling station numbers.

The voter list for each polling station consists of a book printed on paper, which the voter signs (and to which he or she applies a fingerprint in indelible ink). It is important to note that the permanent national electoral registry is also maintained in the form of a book on paper, not a computerized database.[5]

Registration of Candidates

The registration of candidacies in every election process is done in writing—that is, manually—before the director or the regional directors of the Electoral Service. In the case of candidates tied to a particular political party, this is handled by the president and secretary of the party or political alliance to which they belong. Independent candidates may not be registered with any political party, and they must be sponsored by at least 0.5% of the number of citizens who voted in the previous congressional election. This sponsorship must be subscribed before a notary public by candidates who declare, under oath or pledge, that they are not affiliated with a political party that is legally constituted or in the process of being formed.

Voting

The casting of votes is done with paper ballots. These are marked manually by the voter, who then deposits them in a traditional, non-automated ballot box.

On the day of the voting, the voter presents his or her identity document or *cédula* (the only valid and necessary document to be able to vote) to the president of the polling station so that this official can verify that the person's name is in the electoral registry. Once the voter has logged in, using the electoral registry's official sign-in notebook, the person is given a ballot, a pencil, and an adhesive seal. The voter then goes into a booth to mark the ballot in secret. Once he or she is finished, the voter folds and seals the ballot with the number showing and hands the ballot to the polling station president, who keeps the stub with the number on it and hands the ballot back to the voter. The voter then deposits the ballot in the ballot box. Finally, the voter must dip the tip of his right thumb in ink to get his *cédula* back.

Poll workers or polling station officials are citizens designated by the SERVEL among those who vote in the same precinct. From among this group of individuals formed to assist in the process, a precinct president and secretaries are chosen. All the poll workers will formalize the results and submit them to those in charge of the voting sites.

Once the voting is finished, the vote count is done publicly and at the site, with the results read aloud. At each polling station, the poll officials must fill out two tally sheets or *actas* with the voting results; thus, if three elections are held at the same time, six *actas* must be issued, all of them originals. Each *acta* is placed in an envelope, which is closed and signed by each polling station official. One of these envelopes is addressed to the president of the Elections Qualifying Court and is deposited in the office of the Chilean postal service, which for these purposes is located at each voting site around the country. The other envelope is held by the polling station president to be given the following day to the secretary of the respective College of Examiners that will conduct the official vote count.

The copies of the tally sheets and the ballots in the resealed ballot boxes constitute the legal result. In addition, two summaries of results are produced, one to be published at the voting site and the other to be turned in to the Ministry of the Interior.

The latter summary is the one used for the preliminary quick count. An automated information system has been designed for this purpose; it allows the Ministry of the

---

[5]   Registration in the electoral registry is voluntary; however, once a voter is registered, the vote is mandatory.

Interior to transmit results as they are entered into the system, in order to keep the public informed.

Transmission of Results

The concept of a preliminary transmission carried out by the Ministry of the Interior has made it possible for public information to be available during the electoral process. This helps to prevent speculation or the possibility that, simply due to delays in information, the process could be delegitimized either for the "winners" or for those who fall short. Preliminary results are transmitted nationally via the communications media before being submitted for the official vote count. The transmission system begins on Election Day when the Ministry of the Interior reports on the setting up of polling stations and does communication checks with the precincts.

Once results have come in from at least 20% of the polling stations—around 6,000 of them—or by 7 p.m. on Election Day, the Ministry of the Interior convenes the accredited media to provide preliminary information on results. Information is again provided at around 9 p.m., when—on average—results are in for 50% of the polling stations. A new count is provided at the end of the day, and finally the next day results are in for nearly 95% of the precincts.

Since the results are preliminary, the Ministry passes the information on to the TRICEL so that it can go about making them official and can resolve claims or other matters that may be pending, such as ties in voting results. Although the TRICEL is responsible for making the results official, in the majority of cases the preliminary results are sufficiently evident for the different candidates to see whether or not a particular vote threshold has been reached and thus whether or not a seat has been won.

To carry out the preliminary transmission process, the Ministry of the Interior places a computer at each voting site, which is connected to the MININT. Once the polls have closed, an operator transcribes the summary of the result, and this data is transmitted electronically to the Ministry. Based on this information, the MININT prepares its electoral bulletins, posts results on its Web site, and provides information to the political parties through special terminals set up for them. The first preliminary results in this process are generally announced just two hours after the polls have closed.

The first official (not preliminary) results are announced the day after the vote, when the presidents of the polling stations manually tally the results at the College of Examiners, using the *actas* they have taken there personally.

Finally, after a period of two weeks, during which there is time to resolve any claims, appeals, or other disputes, the TRICEL publishes the final official results, which are based on the same preliminary computation system used by the Ministry of the Interior.

3.1.5   Use of Technology in Chilean Elections

The technologies currently being implemented by the SERVEL mainly have to do with providing assistance to citizens, improving user access to SERVEL information, and registering candidates. In 2000, the SERVEL began operating its Web site (www.servel.cl), which incorporates basic information about the Electoral Service and displays vote counts by municipality with information compiled by the College of Examiners. The capacity of the Electoral Service's telecommunications system has been expanded, improving connections with multiple users and communications with citizens. The expansion of these networks has sped up the management of information, both on voters and candidates, and thus improved citizen's service (See Figure 1).

Preliminary Vote Count System

Even though information systems have evolved as new technologies have emerged, the principles behind them remain the same over time—the need to transmit data quickly and securely from the sources of information (the polling stations).

When democracy was first restored in Chile, during the first presidential election of 1990, organizational adjustments were made to be able to monitor results through processes that were parallel to the official ones. Thus, the various centers set up for collecting and transmitting results had networks of people who transmitted tallies by various means to a command

Figure 1: Web site of the Electoral Service
Source: SERVEL

center, where the tallies were systematized and results and projections were generated.

Once the 1990 elections were over, the aim was to implement and regulate a process that was fast, transparent, and secure. The Information Unit of the Ministry of the Interior was tasked with generating the necessary technological aspects for future processes to be carried out successfully. Thus the Ministry of the Interior came to have political responsibility for the electoral process, in charge of disseminating results, making the preliminary counts public, and informing citizens about the process during the course of the elections. Existing regulations were adapted so that the various parties that participated in the process could communicate among themselves and thus strengthen the initial objectives.

Over time, the Ministry of the Interior's Information Unit has made the transition from client-server technology to the current parameters made possible by Web-based technology.

The transmission of electoral results in Chile has undergone constant improvement. The systems or programs were developed initially by the Ministry itself, but later were contracted out through bidding processes that included the participation of large national telecommunications companies. Today this task is the responsibility of the company Telefónica de Chile.

This company has the job of providing electronic communications to precincts around the country, creating parallel transmission networks in order to provide security and to be able to transmit the information in a timely manner. It also has two or three networks that can transmit information simultaneously so that it can be recovered in the case of power blackouts or transmission failures. This company also provides the system's software and hardware; the computer equipment both at the voting sites and at the center where the results come in; and the software used to receive and store bits of data and convert it into information.

In the first few years, this process was monitored by professionals in the information area of the Ministry with assistance from study centers at the country's leading universities, mainly with regard to software development. Over the years, development continued to be done by outside providers, although the Ministry retained ownership of the software. This approach has allowed the Ministry to concentrate its discussions of electoral matters on the electoral system itself rather than on electoral technology.

The current electoral process requires the registered voter to appear at a predetermined polling station at a particular voting site, usually a public school. This is the place from which the information provided will be transmitted, once the polling station has been closed and the votes tallied. This information is recorded in the form of tally sheets that are formalized by precinct representatives and officials.

The use of technology begins, then, with the transmission of the tally sheets, and the collection of these provides a subsequent control in case any type of complaint arises. Once it is recorded and checked for consistency, the data is merged with all the other collected data, and the servers located at the Ministry of Information begin to process it. The vote-tallying systems are integrated with the systems in place for each type of election, and the information is processed accordingly.

Chile is organized into 345 municipalities for elections of mayors and councilpersons, 60 districts for deputies (groups of municipalities), and 19 senatorial constituencies (groups of districts) in 15 regions.

It should also be recalled that Chile has three electoral systems: a simple majority system, a binomial system, and a proportional system. This has required having different information systems. At the same time, elections are carried out in parallel form at various levels: national presidential elections with congressional districts on the one hand, and on the other, elections for mayors and councilpersons. These processes are organized by different degrees of geographical coverage. While the presidential election is national in scope, the same voting process includes a district election (municipality or group of municipalities) and an election organized according to different boundaries in regions that may or may not be comparable in size, depending on the process.

The system therefore merely records the results and provides mechanisms to make them available quickly.

These are organized according to the election in question, using the electoral system governing each process.

System for Official Computation of Results

The procedure for the official computation done by the Elections Qualifying Court also uses information technology. The Electoral Division was created to be able to provide the information needed to qualify elections. This entity is headed by the Chief of the Information Department, under direct supervision of the TRICEL's Rapporteur Secretary. It has separate departments for computing, archiving, digitizing, conducting internal audits, and storing materials.

The Archives Department and the Storage Department fulfill largely manual functions. The former is responsible for sorting the tally sheets received by the court from each polling station and placing them in specially designed files; the latter is in charge of storing the boxes that contain the ballots from each of the polling stations that operate during an election.

For its part, the Computer Department provides the software and hardware used by the TRICEL's computation system for the entry, modification, and codification of the voting information listed in the tally sheets recorded at the polling stations. Specifically, a system is implemented for collecting the envelopes containing the tally sheets from the polling stations around the country. Preliminary reports of the electoral results are subsequently produced; these are handed over to the rapporteurs for their examination and later presentation to the ministers of the Court. Finally, any modifications ordered by the members of the TRICEL are transferred to the definitive databases that will contain the official election results.

The Digitization Department (composed of ten data entry professionals) enters the information contained in the *actas* from the polling places and from the data tables prepared by the College of Examiners.[6] Once the digitization process has been completed, the chief of

---

[6] The digitizers enter the number of votes cast at the polling station, the votes received by each candidate, null votes, blank votes, and the total votes recorded by the polling station. This information is used to generate three error codes: one to indicate that there are objections to votes, another to indicate a mathematical error on the tally sheet, and the last to indicate that the tally sheet from a polling station was not received.

the Electoral Division begins to remove the databases from each digitizer's computer.[7] The Internal Auditing Department verifies that the results entered in by the Digitization Department coincide with the results expressed in the *actas* (tally sheets) from the polling stations.

The chief of the Electoral Division uses two information modules[8] to manage the database with the results. The calculation module helps with the qualification of results, validating any arithmetic process involved in qualifying an election and detecting potential errors. For example, it indicates any polling place with more ballots than registered voters or signals when a particular voting trend with regard to a particular option varies widely from the median result. It also detects whether any option shows zero votes.

The Internal Auditing Department reviews the workbooks produced by the Information Department, which record errors in the tally sheets from each polling station (the official rapporteur makes note of these). The Elections Qualifying Court amends the count if necessary, certifying this step in an *acta* (the liaison rapporteur makes note of

this). This liaison rapporteur's workbook is turned over to the Chief of the Electoral Division, who must make the changes ordered by the Elections Qualifying Court.

To make these changes, the Chief of the Electoral Division uses a modification module to which only he or she has access. This program allows for modification of the databases containing the voting results entered by the Digitization Department. Based on the corrected results, a new notebook is produced with the final results of the qualification. This data is used for issuing the final proclamation of results. The full court does a review to make sure the agreements adopted regarding modifications to the tally sheets from the polling stations have been carried out. To do this, it compares its workbook to the notebook with the final vote count.

The first Monday following a 15-day period after the election, the president of the court, accompanied by the rapporteur secretary, provides notification of the results of the presidential election to the authorities specified in the Constitution. The results are published online (www.elecciones.gov.cl).

Figure 2: Publication of official results on the Internet
Source: Ministry of the Interior

---

[7]   The digitizers have no further contact with the information they have entered.

[8]   There is also a printing program that generates any lists necessary for the process of qualifying an election.

3.1.6 Possible Improvements and Challenges

In general, Chilean society does not consider the introduction of technology into the electoral process to be a current priority. The manual process enjoys a high level of confidence. While technology may be useful to speed up some stages of the process, the perception is that the risk of introducing it outweighs the potential benefits; thus, there is not perceived to be any immediate need for change.

Chile has benefited from technology through the application of the Preliminary Election Results Transmission System for rapid transmission of results, organized by the Ministry of the Interior. Due to the characteristics of Chile's electoral system and the high degree of confidence in the system and its institutions, technology is considered a tool to be applied in isolated cases in which it brings specific benefits to the process. The fact that the results are audited by the MININT, the Preliminary Election Results Transmission System, and the TRICEL has generated confidence among political actors and the general public.

The benefits of a procedure to inform citizens of preliminary results have to do with reducing uncertainty on the part of the public and developing a process that is orderly and regulated by standards and institutions that instill confidence. In addition, having results rapidly available facilitates political understanding; on more than one occasion, the recognition of the results has staved off tensions.

The use of highly secure Web-based technology, along with parallel transmission channels and monitoring systems, has made it possible for Chilean citizens to see timely results from elections across the country, from the most remote locations to the most populous cities. The communications media have also helped to provide fast, timely information about election results through live transmission by radio, television, and the Web. Thus, the media have become another entity that monitors the veracity of election results.

3.1.7 Challenges

The difficulty in registering to vote is due to the lack of systems to speed up the process and store information. To be able to register, the potential voter has to go in person to a local electoral office (open only a limited number of days and hours each month) where the registry book is located. The voter must record his or her name by hand, then sign and leave a fingerprint. The limited hours available are due to the need to physically transport the book every month to the SERVEL office, where the central registry is updated manually.

While the voting abstention rate is relatively low and has remained constant since 1990, a low participation rate by new generations has been noted.[9] To optimize the system for registering voters and to improve participation, possible solutions are being discussed to facilitate the registration process. As a first step, and as of this writing, the Chilean Senate is analyzing a draft reform of the Constitution that would change the voluntary registration system to automatic registration. This would mean that any citizen would "automatically" be included in the voter registry when turning 18 years of age. For that purpose, the Civil Registry and Identification Service of Chile would provide the Electoral Registry with information about citizens who reach voting age and who would be eligible to participate in the electoral process.

As a result of the discussion about automatic registration, a debate has begun on whether or not the vote itself should be obligatory. This has led some sectors to suggest that if the vote continues to be obligatory for those included in the electoral registry, citizens should also be able to "un-register" if they so wish. It is hoped that this system will increase participation, particularly by young people, in the electoral process.

Another challenge will be to use technology to facilitate voting for those who cannot participate due to distance or physical disabilities, so as to provide the facilities needed for greater participation in the electoral process.

---

[9] According to SERVEL statistics, for the 2008 election of mayors and councilpersons, there were 654,636 registered young people between the ages of 18 and 29, out of a total population in that demographic of 2,450,000. Young people represented 8.07% of the electoral registry.

3.2 Costa Rica

3.2.1 Background

According to statistics of the International Telecommunication Union published in 2006, Costa Rica is among the nations with medium-to-high digital access, and it holds fourth place in Latin America in this regard, after Chile, Uruguay, and Argentina.

Moreover, according to information from the company Radiográfica de Costa Rica S.A. (RACSA), as of November 2007, 39% of homes had computers, and of these, 41% of these were connected to the Web. The total number of citizens with access to the Internet is reported to be 35% of the population (the same percentage that have cellular telephones in the country). This percentage has been on the rise, increasing from 20% in 2004, 22% in 2005, 26% in 2006, and 30% in 2007. According to a study by the Economic Commission for Latin America and the Caribbean (ECLAC), 97% of Costa Rica has electric power.

3.2.2 Institutional Framework

The 1949 Constitution of Costa Rica separated the electoral bodies from the other branches of government. It created a body with extensive authority and complete autonomy, called the Supreme Electoral Tribunal (TSE), whose members are appointed by the Supreme Court of Justice.

Under Chapter III, Articles 99 to 104 of the Political Constitution, the Supreme Electoral Tribunal is the highest constitutional body in the area of elections and thus, is responsible for the organization, management, and oversight of any acts having to do with elections. It functions independently. The other electoral bodies, such as the Civil Registry and the Electoral Boards, report to the Tribunal. The Electoral Boards are of a temporary nature and comprise the boards for each canton and precinct.

The Supreme Electoral Tribunal is ordinarily composed of three permanent magistrates and six alternates.

Beginning a year before and up until six months after elections for president and vice president of the Republic or for representatives to the Legislative Assembly. The Tribunal is made up of its permanent members along with two alternates chosen by the Supreme Court of Justice. This five-member Tribunal is in place for the electoral period.

Article 104 of the Political Constitution of the Republic indicates that "it is the obligation of the Civil Registry to manage the Central Registry of Civil Status and create voter lists." This entity reports exclusively to the Supreme Electoral Tribunal and has two large areas, the Civil Department and the Electoral Department.

The Civil Department receives all information having to do with births, deaths, marriages, and any other information that may modify the original registration (legitimating, recognitions, divorces, legal separations, name changes, etc.). This registry of civil status constitutes the basis of the electoral registry.

The electoral registry is updated automatically, based on modifications to the civil registry. This allows for a projection of the number of voters and polling stations, which facilitates the process of acquiring election materials.

3.2.3 Legal Framework

Article 94 of the Electoral Code establishes that: "The President of the Executive Committee of the highest body of each party shall appoint: a) two regular auditors who shall be accredited to the Supreme Electoral Tribunal; b) two permanent auditors accredited to the Civil Registry; c) during the pre-electoral period, an auditor for each section of the Civil Registry may be accredited; and d) a regular auditor and an alternate for each of the regional offices [accredited] to the Civil Registry." This authorizes the parties to have auditors monitoring the entire electoral process.

There are regulations in place requiring the Supreme Electoral Tribunal to publish a provisional voter list and make it public in accordance with standards established by law. This allows citizens to become informed about their electoral registration and carry out any necessary procedures to change their election address before the list is closed definitively.

In terms of legislation that refers to electoral technologies, Article 104 of the Electoral Code indicates:

"Voting shall be done through separate paper ballots for each election. In printing the ballots, the Civil Registry shall order any separation necessary. Nevertheless, the Tribunal may employ electronic means for voting when it has reliable, secure instruments at its disposal. If that is the case, it may dispense with the paper ballots and the procedures inherent to their use."

Thus, the electronic vote is explicitly permitted, providing that reliable, secure means are guaranteed.

3.2.4 Electoral Registry

The automation of the electoral registry (Padrón Nacional Electoral) dates back to 1977, when the registry was partially digitized, recording voter information on perforated cards that could be read by the information system. The electronic record contained only personal data (no images), since there was a separate photographic file (on paper) that included the most recent photo of the voter. These photographic files would be sent to each polling station, in a separate box from the voter registry, for consultation in case any doubt arose about the voter's identity.

In 1990, the Integrated System for Electoral and Civil Information (SIIEC) was created, which established the latest-generation electronic databases as a pillar of the new information system.

The photographic record was digitized completely in 1997, with the Implementation of the Integrated Identification Document System (SICI). Thanks to the electronic storage of images of voters, this system could integrate both personal data and photographs of citizens in a single

document. This document was used for the first time in the 1998 presidential elections.

The changes made to the voter registry responded to a need to modernize the process of recording, storing, and printing citizen data. The process included training poll workers and voters through the use of manuals.

The contracting of services for digitizing and subsequently updating all photos of citizens was done through a public bidding process. Initially, 29 national and foreign private companies declared their interest; however, in the end only three offers were admitted. Only one of them fulfilled all the requirements under the terms of the bidding process, and this was the firm that was contracted. The contract signed with this company amounted to a total of (U.S.) $4,170,464.

In addition to the technical specifications, the terms of the bid indicated that the image management software should be able to display several images on the screen for comparison and analysis, and that the provider should have the necessary uninterrupted power supplies (UPS) to provide backup electricity. Bidders were asked to conduct technical tests that would support and demonstrate their solutions. The software and databases are the intellectual property of the Supreme Electoral Tribunal.

The *cédula de identidad* is the document that every citizen must carry as personal identification, and it is the document required to cast a ballot. It includes the citizen's key information, as well as his or her photograph, signature, and fingerprints (in a barcode). The *cédula* number is composed of numbers from the person's birth registration, indicating the province and the volume and page of the birth record. It also contains security elements to guarantee its authenticity (See Figure 3).

At the end of 2008, Costa Rica had more than 2.7 million voters. The 1977 electoral registry was a physical medium, and there was a risk that at some point in issuing, filing, updating, or processing the registration "cards," information could be lost or stolen. Major efforts were also involved in information storage, in terms of both safekeeping and infrastructure. The 1997 innovations sought to enhance the security of the registry information (data and photographs) stored on electronic databases

Figure 3: Features of the identity document
Source: TSE

and speed up searches and data processing, among other things. As of this writing, the possibility is being studied for poll officials to use a completely digital voter list. This would allow poll workers to use an information system that reduces the time spent searching for voters on the list and automatically downloads information to certify that the citizen exercised his or her right to vote.

The technical characteristics of the first electoral registry are described in the Organic Law of the Supreme Electoral Tribunal and the Civil Registry which states, "The registration of voters shall be done using perforated cards, through a system of electric machines or through the recording of data on magnetic disks or tapes. These cards or recorded data will form the basis for producing both the provisional and final voter lists as well as the list used by each polling station."

Improvements to the electoral registry as a result of the modifications introduced in 1997 have included the creation of a voter list with a photograph, the incorporation of data to the TSE Web site, and the

installation of an Interactive Voice Response (IVR) System to assist citizens.

Unlike other countries, Costa Rica does not conduct a census of voters before holding elections, but rather works on a permanent basis to register new voters, record changes of address, and exclude those who have died or who have lost their eligibility to vote due to criminal convictions. The application for an identification document or *cédula* fulfills a dual purpose in this regard, since the civil registry's order to issue a *cédula* for the first time also triggers the person's inclusion on the electoral registry.

It should be noted that the registry is updated on a daily basis. The system for issuing identification documents has recently updated its printing system so that more modern printers can be used. Its searching and matching capabilities have also been updated so that when an application is made for an identification document, the system can automatically identify the person. Another modification was in the use of the jukebox (a robotic device for storing data, which can automatically upload

and download various types of optical disks such as CDs, DVDs, etc.); this update means that fingerprints, photographs, and signatures can be stored in a single file, instead of separately as before.

Despite the fact that the SICI system has its own internal backup system, manual contingency plans have also been established that allow a *cédula* to be issued during brief moments or periods in which the central system may be out of service.

Administrative systems and technological advances have made it possible to select or consult the electoral registry efficiently, particularly with the use of computers. Controls are performed to check inclusions and exclusions, so as to ensure that the registry is kept free of errors and that those on the list are really voters.

Initially, the contracted companies prepared the voter registry with the photographs, until the Tribunal staff acquired the necessary expertise. Since the 2006 national elections, the institution's staff has prepared the voter registry with the photographs.

The TSE publishes a provisional voter list and makes it public in accordance with the law so that citizens can be informed about their voter registration and can perform any necessary procedures to change their voting address before the list is closed definitively. The publication of the list is done six months before the election; the process uses the Web, an interactive voice response system, a medium for physical printing, and electronic storage media.

The next challenges are to modernize the registry so that it can have greater security features and be more useful to citizens. For example, an electronic device could be added so that the citizen could identify himself or herself both in the physical world and online. The identification document's security features could also be improved with the application of more modern printing techniques, such as laser printing, that prevent the deterioration of people's photographs. The quality of the materials used to make the *cédula* could likewise be improved to prevent deterioration as a result of use.

The technology used in this process includes:

- Electronic database.
- Integrated voice response system.
- Integrated identification document system.
- Internet.
- High-capacity and high-definition printers.
- Scanners.
- Biometric identification.

3.2.5 Data Transmission and Consolidation of Results

The Committee on Data Transmission was established for the transmission of data in Costa Rican elections. It is composed of representatives of the state institutions responsible for communications, who under the electoral law, provide the Supreme Electoral Tribunal with any support it may need to transmit election results easily and quickly.

Once the traditional manual voting process has been completed at the voting sites, the results are transmitted from the receiving and transmitting centers (CRTs), which have computers linked to the Supreme Electoral Tribunal.

The CRTs are typically installed in the Supreme Electoral Tribunal's regional headquarters, but, where possible, CRTs are set up at all voting sites so that the information can be transmitted from the closest possible place to its source. The 2006 national election process tried to expand coverage for electronic data transmission with the installation of CRTs at voting sites (information labs at schools, nursing homes, and prisons), as well as in local post offices and the regional headquarters of the Supreme Electoral Tribunal.

At voting sites where it is not feasible to transmit electronically via the Internet, the "message" (tally sheet) is transported physically, or else the public telephone network is used to transmit the results to the TSE regional offices or to the post offices. In these cases, the transmission is done via voice or fax, depending on the technical facilities available (See Figure 4).
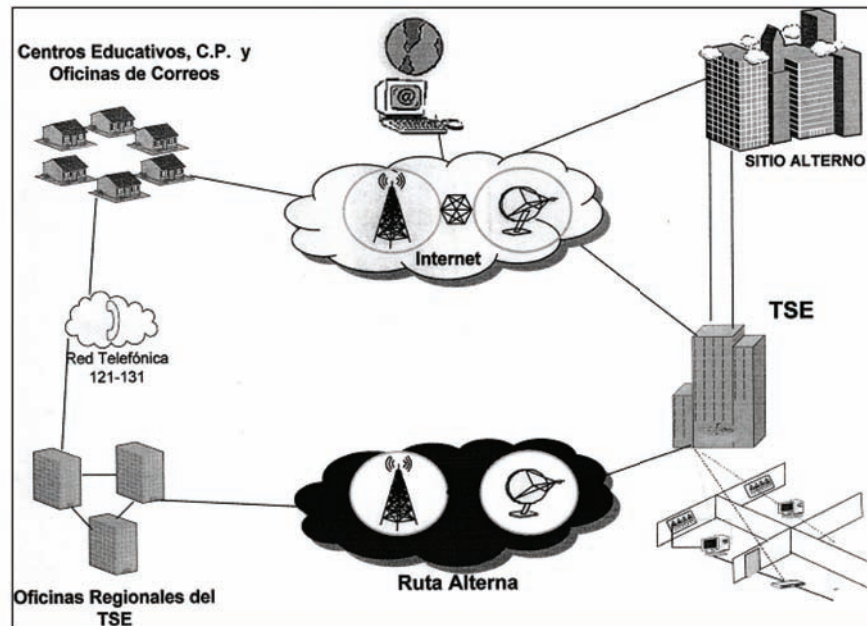
Figure 4: Simplified data transmission diagram
Source: TSE

The information that arrives at the TSE via the Internet uses strict security measures (https: a security protocol for transferring hypertext, which uses an SSL-based code to create a more appropriate channel for sensitive information). The data travels in encrypted form at a rate of 128 bits (encryption with a public or asymmetric key that makes it possible to preserve the integrity and not reject data). The various controls that are implemented come from the application of best practices on matters such as ISO 27002 (for information security) and COBIT (Control Objectives for Information and Related Technology).

The center to consolidate and tally the data is set up in San José, the country's capital; this CRT also acts as a center for processing any inconsistencies detected during the digitization of the results ("messages"). For the San José CRT, at least one alternate site is established that is fully equipped to continue this processing in case the main site is out of operation.

The San José CRT is connected directly to the main computer. The other CRTs use the Internet to transmit the messages to the TSE's main computer (See Figures 5A and 5B).

The system for capturing messages (tally sheets, or *actas*) was developed by the TSE on a Web-based platform and is based on the following processes:

a. Use of digital certificates to sign the data to be sent (in order to verify the origin of the transmission).

b. Entry of user data and password.

c. Selection of the polling station that is doing the transmitting, and the type of election.

d. Review of the data by the poll workers.

e. Entry of the results from the polling station.

(See Figure 6)

If problems arise in the transmission of results, redundant lines are used as backup measures, and as a last resort the transmission can be done by fax or by telephone.

The consolidation center is protected by firewalls and Intrusion Detection Systems (IDS). The network is also segmented and has a backup service with the same services as the official one.

The security measures taken into account are the following:
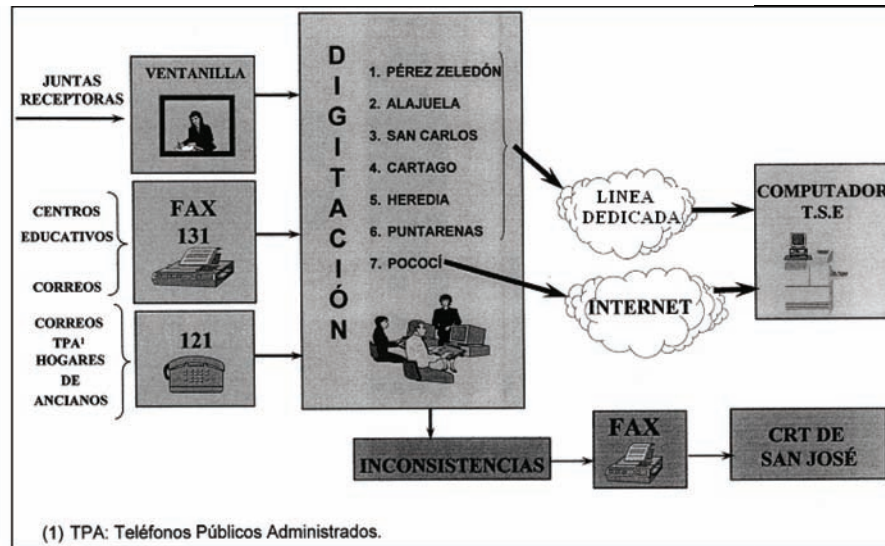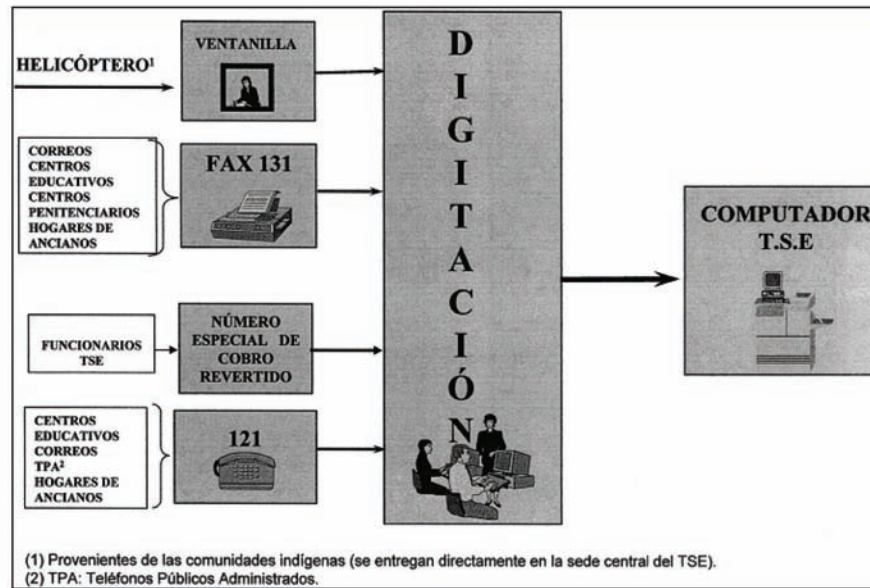
Figure 5A and 5B: CRT Setup at TSE regional offices (2006 national elections)
Source: TSE

1. Digital certifications for connections via a secure port (https) and the authentication of the user who is connected.

2. Validation of the certified user with the active directory.

3. Digital signature for transmitted data.

4. Delivery of codes and certifications in sealed envelopes and security pouches.

5. High-tolerance equipment.

6. Redundant links.

7. Asymmetric encryption.

8. Digital certification for the identification of each server.

9. Antivirus software at every level.

10. Segmentation of the various layers and services needed for the platform.

11. Firewalls and intrusion prevention systems for protecting different network segments.

The physical security measures include the following:

1. Access via the main door to the computing center restricted through electronic registration.

Figure 6: Conceptual model of the data capture process
Source: TSE

2. Logbook of individuals who enter the computing center.

3. Restricted access to the room containing the servers: a door with the same access mechanism as the computing center and with additional access restrictions.

4. Logbook specifically for access to the room with the servers.

5. Visitors allowed only when accompanied by an authorized official.

6. Recording with a security camera.

7. Ban on using USB devices or disks without prior authorization.
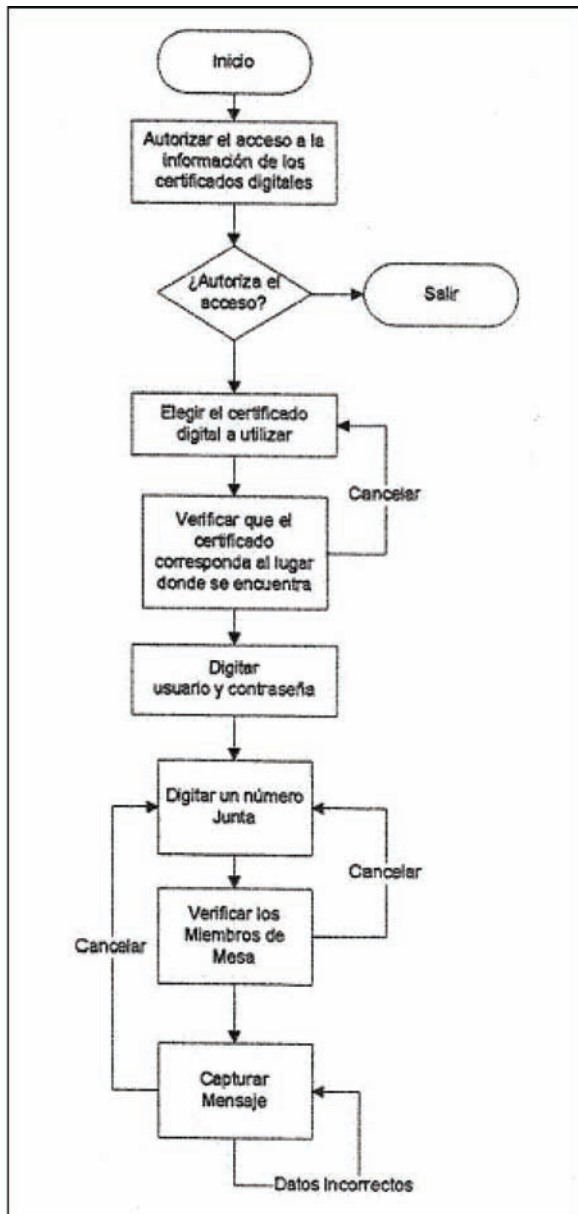
The application generates detailed reports from each polling station for consultation and follow-up by the Committee on Data Transmission. The data published for citizens is provided on a more general level, at the level of territorial divisions, depending on the type of election. Thus, for example, results for presidential elections are presented at the national and provincial level, while results for the election of deputies are provided at the provincial level. The data is published on the Web.

The results that are obtained and published on Election Day are considered preliminary results, since the official result follows the manual count of each ballot used in the election. Nonetheless, preliminary results are published frequently. Every time there is a "cut" (a consultation of information at a determined point in time), the results in question are published simultaneously on the Tribunal's official Web site, in XML format (standard for sharing structured information among different platforms). In addition, each cut is sent by e-mail, with a digital signature, to the addresses of media outlets that had registered with the Tribunal.

For the 2006 national elections, the costs of the entire process of transmission, consolidation, and publication of results came to nearly (U.S.) $600,000.

3.2.6 Electronic Voting

In the 2002 municipal elections, electronic voting was introduced on a partial, pilot basis. It was used at 19 voting centers and 133 polling stations for just over 50,000 voters, or 2% of nationally registered voters.

As of this writing, studies are underway to determine the feasibility of implementing the program for the 2010 municipal elections. It is believed that with the implementation of electronic voting, the number of voters per polling station could be increased to 750 instead of the current average of 500.

The proposed solution for an electronic voting system consists of a conventional personal computer located inside a container or frame. This frame would provide security and also facilitate the use of the computer for those who might be fearful about using it, since they would see only a screen and a numerical keypad.

A compact disk (CD) previously prepared by the Supreme Electoral Tribunal is used to start the system. The CD contains the voter list for that polling station and the software installers. Once the system is loaded, the official opening *acta* or certificate is printed out; this is signed by the poll workers at the start of the election and must show that each of the candidates has zero votes.

The voting process is as follows:

1. Waiting for voter. Inside the secret voting booth, the screen displays the message "Waiting for Voter." It will remain like this as long as no voter is casting a ballot or once the person has finished voting.

2. Activating the system. Once the elector has shown the poll workers his or her identification card and the poll workers have verified that the person is eligible to vote at that site, the president of the polling station—without leaving his or her seat—activates the system so that within two minutes voting can be done electronically in the secret booth.

3. Casting the ballot. As soon as the voter enters the booth, the screen is activated. It shows the entire electronic ballot in ascending order by each candidate's number. Using the numerical keyboard adapted for voting, the elector presses the digits that correspond to his or her preferred candidate. The screen immediately shows a large view of that selection and if that is correct, the voter presses "YES" to confirm; otherwise, the voter presses the "NO" key and has the option to select another candidate or to cast a blank vote. This procedure is repeated for each type of vote that is cast.

4. Printing a receipt. Once the citizen has finished voting or the voting time (two minutes) has expired, a voting receipt is printed out for the voter to fold and place in a ballot box (If the system has shut down because the time has expired, the vote is counted as a blank vote if the voter had not yet made a selection.)

5. After the voting. Once the elections are over, the system automatically deactivates the polling station, generates the applicable support material, and prints out the *acta* declaring the poll closed along with the records with the vote results.

Figure 7: Keypad for electronic voting
Source: TSE

At voting centers that have the required equipment, the election result is transmitted immediately to the central computer of the Supreme Electoral Tribunal. Next, a text file is automatically generated with the voting result, a copy is saved on a local hard drive and another on a diskette, then a small screen pops up that makes it possible to send the text file to the central server that will receive and process the information.

Since the percentage of the voting population that could participate in the pilot program was very limited, a personal invitation signed by the TSE magistrates was sent to these voters, asking them to participate in the demonstration as well as in the voting itself. One week before the process was to take place, the voters were

convened for a demonstration of electronic voting so that they would be familiar with how the system worked.

The voting system uses conventional computers that were acquired through a public bidding process. The system was developed by technicians from the Supreme Electoral Tribunal; thus, the electoral body retains the intellectual property on the application.

During the implementation of the electronic voting pilot plan, logistical weaknesses were observed. Using traditional PCs meant having to take into account the storage and distribution of the central processing units (CPUs), monitors, keyboards, conventional printers, and UPS batteries. In the case of the batteries, the problem was that they did not have the capacity to function continuously for the entire 12-hour voting period, in case of an interruption in electric power during that period.

In the pilot program, the security measures used were physical. The vote was saved both on the hard drive and on a diskette. It was also printed out on a receipt that was reviewed by the voter, who had to deposit it in a ballot box in front of the poll workers after showing them where they had signed the back of the receipt. Additional security measures included placing seals over vulnerable parts such as the disk drive, and differentiating the various cables with colored stickers. An acrylic cover was also placed over the keyboard so that only the numerical keyboard could be seen and manipulated. The CPU was also located at a distance so the voter could not manipulate it or turn it off. The printer, for its part, was totally covered except for a slot from which the voter could retrieve the receipt.

In addition, each of the technicians, depending on his or her position, had a code to access the computer. Data was encrypted and stored on various devices to serve as contingency mechanisms.

It is worth noting that various system tests were carried out, to which the political parties were invited. The system was also explained in detail to the parties' accredited technicians. In the pilot plan, no party objected to the system or to its results; that is, all the votes cast through the system were valid for the election.

3.2.7 Challenges

As of the date of this report, a new study is being done for the implementation of electronic voting, with support from the Technological Institute of Costa Rica. It will analyze additional security measures as well as legal aspects related to the regulation of the voting process. The current study is considering the possibility, among other things, of a barcode reader, an alternative energy source (battery), two storage devices (one removable), voting by keyboard, and a container, similar to a ballot box, for voting receipts (which the voter could see but not handle).

The main conclusion of the electronic voting pilot program is that it is possible to extend this voting system for the entire country in future elections. The recommendation is to implement an awareness campaign to educate citizens about electronic voting.

As far as the electoral registry is concerned, there is a need to improve the security specifications of the identification document, applying more modern techniques and materials to the printing process (such as a laser printer); speed up the process of applying for and delivering the identification document so that this is instantaneous; and make it possible for the identification document to store the digital signature and certificates. These improvements could lead to a voter registry that is fully electronic.

In terms of the integrated system for data transmission, plans are underway to improve the presentation of results on the Web so that data is displayed more dynamically and in a way that is more visually appealing to citizens. The plan is also to provide portable devices, such as portable computers and cellular phones, for those who transmit results from the CRTs.

3.3 Jamaica

3.3.1 Background

The Electoral Office of Jamaica (EOJ) has used information technologies to improve the electoral process since 1997. A major focus of its activity has been voter registration and identification, mainly through the introduction of an Automated Fingerprint Identification System (AFIS).

Information technologies have also been used extensively to invigorate the election organization process itself (personnel training and management, communications in the field, and the handling of complaints).

In recent years, efforts to introduce a new GIS-based Election Information Management System (EIMS) have taken center stage.

3.3.2 Institutional Framework

Jamaica is a parliamentary democracy based on the Westminster model. Its bicameral parliament consists of an appointed Senate and an elected House of Representatives. The House of Representatives has 60 members, corresponding to 60 constituencies, which are grouped into 14 administrative parishes. Its members are elected by popular vote in a general election and serve as members of parliament for a five-year period. The Senate has 21 seats, 13 appointed on the advice of the prime minister and 8 on the advice of the leader of the opposition. Significant constitutional changes require a two-thirds majority in both chambers; thus, for example, to make a major change, at least one opposition appointee would have to vote with the government representatives in the Senate. General elections must be held within five years of the forming of a new government.

The governor general, an honorary appointment made on the advice of the prime minister, represents Queen Elizabeth II of Britain as head of state, and performs largely ceremonial functions, though formally possessing a reserve power to dismiss the prime minister or the Parliament. Following general elections, the governor general usually nominates the majority leader as prime minister and recommends the members of the prime minister's Cabinet. No fewer than two and no more than four members of the Cabinet must be selected by the Senate.

The Electoral Office of Jamaica, headed by the director of elections, is responsible for operating the electoral system and conducting the island nation's elections, employing and deploying election officials. On Election Day, a presiding officer and a poll clerk staff each polling station; they report to the returning officer in each constituency. Immediately following the vote count, returning officers report preliminary results electronically to the Election Centre, where the director of elections controls operations.

The Jamaican Electoral Commission (JEC) replaced the Electoral Advisory Committee (EAC) in December 2006. It has nine members: four nominated (two by the People's National Party, two by the Jamaica Labour Party), four members of civil society, and the director of elections, who is a non-acting member. This structure replaces that of the EAC, which had been in effect since 1979 and had eight members: two nominated by the prime minister, two nominated by the leader of the opposition, three independent members, and the director of elections. The new JEC structure gives equal weight of voting numbers to political parties and members of civil society. The JEC also carries greater authority than the previous EAC and can enforce compliance with its recommendations.

3.3.3 Legal Framework

The legal framework that governs elections is made up of a number of laws, in particular the Representation of the People Act, the Political Ombudsman Act, the Election Petitions Act, and the Criminal Code.

The Office of the Political Ombudsman was established in 2002 and is responsible for investigating complaints and problems in the political arena. The political ombudsman is required by law to investigate complaints made to his or her office—for example, complaints about intimidation and harassment or other improper or illegal activities by politicians and their supporters. The ombudsman has the authority to appoint a tribunal made up of political party representatives to assist in the investigation process. Complaints may be made by any individual or group of individuals who claim to be affected by any such action by members of a political party. From nomination day to Election Day, the political ombudsman makes all his rulings public, stating why he has come to a decision and what action he or she has determined the political actors should take.

The Election Centre was established within the EOJ in 2002 to facilitate the management, transparency, and interaction of all stakeholders in the period between the nomination of candidates and Election Day. The Election Centre includes representatives of the main political parties—the People's National Party (PNP), the Jamaica Labour Party (JLP), and the National Democratic Movement (NDM). It also includes the participation of the political ombudsman, a representative of the civil society group Citizens' Action for Free and Fair Elections (CAFFE), a representative of the Jamaica Constabulary Force, and the director of elections. The Election Centre holds regularly scheduled meetings to discuss any issues that may affect political or electoral matters; political matters are handled by the political ombudsman and electoral matters by the director of elections. The Election Centre provides a safe, functional forum for conflict resolution, one in which the represented parties and others who are interested can raise complaints, report problems such as acts of election-related violence, and see immediate action taken on these issues. It is equipped with telephones, computers, and databases that allow it to track incidents and follow up on actions and results. It issues daily press briefings, combating the spread of rumors and misinformation that in the past have fed acts of violence during the election period.

All Jamaican citizens who have reached the age of 18 are entitled to register to vote, provided they are residents of Jamaica on the date of registration. Citizenship is bestowed based on birth, parentage, or marriage. Citizens of the Commonwealth of Nations (made up of 53 independent countries which, with the exception of Mozambique, share historical ties with the United Kingdom) may also vote if they have lived in Jamaica for at least 12 months prior to registration. Dual citizenship is recognized in Jamaica for voting purposes, but dual citizens are not qualified to be appointed to the Senate or elected to the House of Representatives. Election workers and members of the police and armed forces cast their ballots a few days before the general election to allow them to do their work on Election Day, managing and securing polling sites.

3.3.4   Election Registration System

Origins of the Voter Database and ID Cards

The initial motivation for introducing information technologies in the EOJ stemmed from problems in the voter registration system. Before 1997, voter registration was done "house-to-house." The system was labor-intensive and inflated the electoral registry (by 10 to 20%) with duplicate registrations.

Both legislative changes and new technologies were used to tackle the problem. In 1994, new regulations were introduced allowing for the ongoing registration of voters and a permanent electronic database, along with the requirement to produce a voter list from the database every six months (May 31 and November 30). To be included on the voter list, citizens had to have registered at least two months before the date of its publication. These timeframes were established to ensure that the voter's place of residence could be verified physically before allowing the registration to be processed.[10]

In 1996, following a selection process among seven different company proposals, a contract was awarded to a U.S.-based company for a total of (U.S.) $17.2 million. The vendor was to establish a total of 67 regional registration centers, with equipment able to digitally record a set

---

[10]   Verification of residence accounts for the most significant delay in the process of completing the voter's registration.

of ten fingerprints, a photograph, and demographic data during the launch of a house-to-house registration process. Once the registration data had been stored in the database, the vendor was to cross-check fingerprints in order to find and eliminate duplicate registrations and come up with a "clean" list. The EOJ would use that culled list to produce a set of printed voter lists[11] (Black Books). The vendor was to produce new voter identification cards, which would include the voter's fingerprint information and demographic data on a magnetic strip. Voters who picked up their new identification card would have their fingerprints taken again, to compare them with the ones stored in the database and thus ensure that they were the card's rightful owners. On Election Day, the same technology would be used to identify voters at the polling stations.

The system's strength was the conceptual design of the solution: the kick-off registration process was similar to previous house-to-house registrations, which had been effective in gathering the required data. By contrast, the processing of the data proved to be the system's weakness.

For the 1998 elections, the cross-check of fingerprints could be only partially completed due to technical problems with the comparison system; by the date of the elections, verification and comparison had been completed for only 18% of the registered population. Since one of the main objectives of the new database was to reduce duplications, this was a significant setback.

Of the registrations that were checked, only around 300 duplications were found, of which only 20 were cases of intentional double registration. Taking the 18% as a large sample, it can be assumed that similar percentages would turn up in the population as a whole. Apparently, awareness of the new verification system had discouraged those who might commit fraud, producing many fewer attempts at double registration than in previous years. Thus, the objective of reducing duplications was met after all.

While a new, culled voter database was achieved, its counterpart—the new identification cards—could not be produced in sufficient numbers in time for the elections, even after the EOJ designated an additional manufacturer. Only 322,000 cards were ready in time for the election, and not all of them had been distributed to the voters.

At the same time, pilot trials conducted at the Regional Election Centers showed that the fingerprint identification system that had been installed was prone to error and hard to maintain, causing data integrity problems. After a short period of use, the EOJ decided to discontinue using the system.

The lack of a sufficient number of ID cards, combined with problems with the AFIS scanners, meant that the 1998 general elections could not be held exactly as planned. As a contingency measure, the EOJ reverted to "proven technology"; it distributed the printed voter lists (Black Books) and used indelible ink to mark those who had voted. However, printing had to be done on short notice, capacity was limited, and there was not enough time to check for errors. As a result, on Election Day a significant number of Black Books intended for the voting sites were incomplete or arrived late to the polling stations. Hence, voting took significantly longer than expected.

Finally, an incident in which several hundred blank ballots were found on the premises of a political party office gave rise to accusations of fraud. It was later clarified that the printed ballots were inadvertently sent to the party headquarters along with the voter lists. For this reason, the remaining stock of ballots was audited; it was determined that no harm was done and the election had not been influenced by the event. Nonetheless, the issue of ballot security had been raised—and was subsequently addressed with the introduction of a new system.

Evolution of the Voter Registration System

For the 2002 elections, the complete voter list was checked using fingerprints to detect duplications. Close to 900,000 validations were performed automatically by

---

[11]   Black Books are summaries of voter data. They contain more than basic information, as they include answers to such questions as, "In what parish were your parents born?"; "What is your mother's maiden name?"; and "What is your wife's occupation?"

the system, with nearly 200,000 needing forensic manual inspection for matching.

In addition, the list was culled using a combination of methods, most of them manual:

- More than 10,000 names were purged based on death certificates and notices.
- The names of more deceased were identified in the process of distributing the voter identification cards, with confirmation provided by neighbors.
- Monthly meetings were held with political party representatives at the constituency level, where voter lists and the names of new registrants were distributed to each political organization for the purpose of verifying their accuracy.

The cases in question—approximately 5% of the original list—were published in the largest-circulation newspapers and in the constituencies. The voters were cited to meet with the constituency returning officer to present and justify their inclusion and retain their right to vote. With the application of these methods, the 2002 voter registry was considered one of the cleanest in the country's history.

The registration process was modified to work without on-site AFIS technology, but rather with paper forms. Voters leave their fingerprints on the forms along with their other information. Once the residence verification has been completed, the forms are sent to the central processing site.[12] The forms contain demographic and fingerprint data, as well as printouts of the voter photographs taken at the time of registration. At the central site, data entry clerks enter the demographic data into the system and scan the fingerprint forms. The process, from data entry to card production, takes from one to seven days, depending on the number of registrations being processed.

In 2006, the EOJ decided to switch vendors for the process of fingerprint verification, in order to be able to transition from regular compressed images to the Wavelet Scalar Quantization (WSQ) Format. WSQ is the current standard format for exchanging and storing fingerprint images. A new system, called the Programmable Matching Accelerator (PMA), was purchased and integrated with the existing fingerprint database, which was converted to the new format.

On-site Biometric Identification

In late 2001, the EAC decided to give Election Day fingerprint identification another try. A U.S.-based vendor won a competition for a new contract worth (U.S.) $16.8 million ($13.9 in hardware and $2.9 in software).

The EOJ considered testing the newly purchased software—called the electronic voter identification and ballot issuing system, or EVIBIS—at selected polling stations in the 2002 elections; however, it ultimately decided not to use it that year.

Much like the system that had originally been purchased in 1997, the EVIBIS is able to identify registered voters at the polling station using their fingerprints. According to the EOJ's Theisea Allison Malcolm:

"EVIBIS allows for the identification and verification of electors and the issuance of an authenticated ballot at the polling station on Election Day. Electors first attempt to be identified by their fingerprints then a second finger is used for verification. If the identification by fingerprint fails then the user will go to elector lookup on the electronic voters' list, once the elector is found, verification takes place by doing a one to one fingerprint cross-match. If the fingerprint verification fails the system has an exception processing capability that is used to identify the elector. Exception processing requires the elector to provide correct answers to a number of personal questions that were collected at registration. Once the elector is identified and verified by the system, an authenticated ballot is printed and the elector de-activated to prevent them from voting again. The EVIBIS software architecture is comprised of a 32-bit Windows graphical user interface developed under Visual Basic and supporting an object-oriented design. The EVIBIS software utilizes the Microsoft Access DBMS to store and process all elector transactions. There are two types of security controls, the User Level and the Data Level, access is granted to the software via username and password and different users are given different access levels. EVIBIS software, database and

---

[12]   Logs for each batch of forms sent are created at the registration site and compared to logs at the central site to ensure that all of the forms are in fact received.

fingerprint data are stored in a secured data partition on the hard disk in an encrypted format."

The system also offers the capability of printing a "ballot on demand"; once the voter is identified, the machine prints out a ballot. The voter then proceeds to vote manually, marking the paper ballot with a pencil. This simplifies election logistics, as it is no longer necessary to ship ballots to the polling stations, and the ballots printed by the system are authenticated and accounted for. Since the handling of ballots was a significant problem in previous elections, on-demand printing with these security features is a significant advance. Ballots are issued only to voters identified by the system. However, in the current implementation, the system allows a manual override for a small fraction of voters who fail the AFIS identification system due to poor-quality fingerprints and who also fail exception processing (questions from the Black Book) but who are positively identified by the presiding officer at the polling station as the actual voter.

In the 2003 and 2005 elections, pilot trials of the EVIBIS software were conducted, each time in one constituency. In 2007, the system's use was extended; it was used in 13 constituencies (out of 60), with 5 fully covered by the system and 8 partially covered. Emphasis was given to "at risk" polling stations where fraudulent activities had tended to take place. Many of these were in "garrison communities" heavily dominated by supporters of one political party with very limited participation by the opposition. The system's performance in the field was satisfactory, suggesting that its use could be expanded.

The EVIBIS software allows for quick voter identification and verification. Authentic ballots are easily identified, and thus it is also easy to spot fraudulent ones. On the downside, the system is susceptible to computer and printer failures, and the logistics involved in replacing equipment on Election Day can cause significant delays.

Other issues have to do with costs and training. Each field system costs (U.S.) $3,000, and extensive training is needed (at least six training lessons) for the EVIBIS to be used.

The current voter ID card, introduced in 2008, has added security features such as a bird-shaped hologram and a three-dimensional barcode on the back to discourage falsification (See Figures 8A, 8B and 8C).

The blank identification cards are purchased from a U.S. vendor, and the voter information (personal information, photo, signature, barcode, and fingerprints) is printed on the cards at the EOJ, using card printers acquired from another U.S. company.

The printers are located in an AFIS-secured room. Currently two machines are in use, one with a capacity to print 1,500 cards per hour and the other with a capacity of 350 per hour. The information to be printed is retrieved from the EOJ database using an internal network.

Strengths and Weaknesses

The card itself, with its added security features, provides ample protection against falsification. Since identification cards are not obligatory for voting, and since the trend with EVIBIS seems to be moving toward general identification done directly with fingerprints, it is still unclear whether the ID cards will at some stage be completely replaced with that method or if they will somehow complement the biometric identification process.
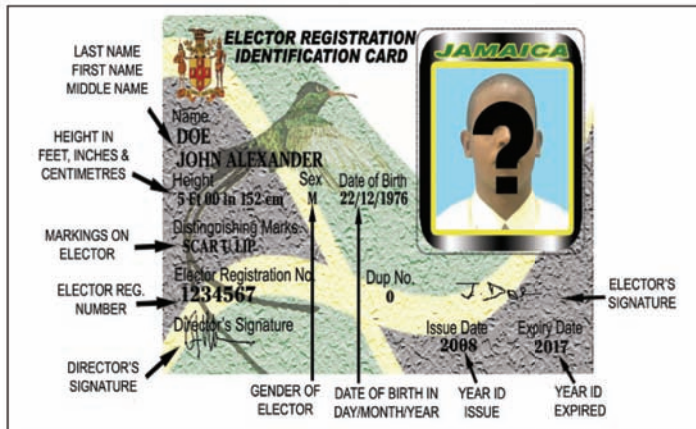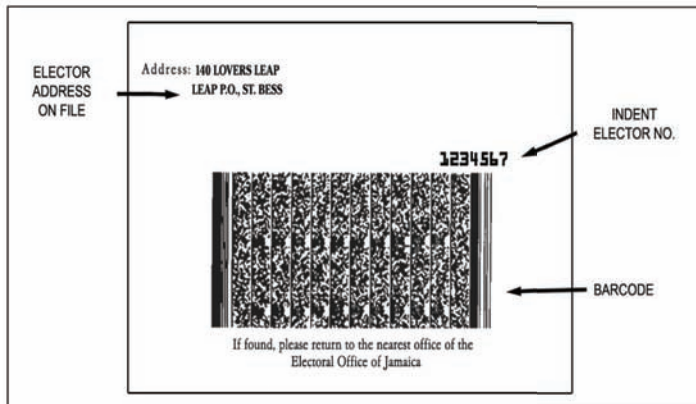
Figure 8A: Front of voter ID card
Source: EOJ

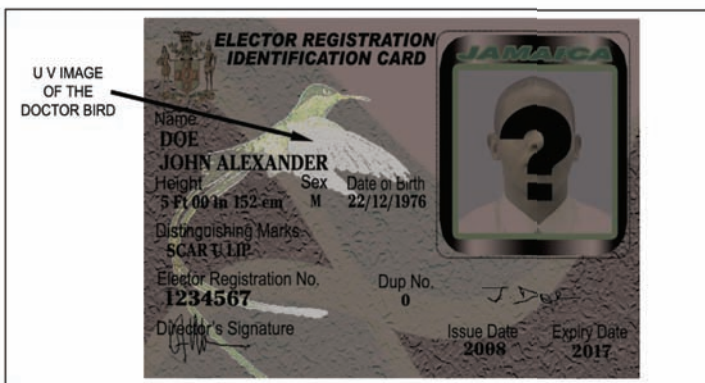Figure 8B: Back of voter ID card
Source: EOJ

Figure 8C: Security feature of the voter ID card
Source: EOJ

3.3.5 Election Information Management

In past elections, Election Day visibility both for the EOJ and for the public was limited. The first system for transmitting preliminary results was used in 2003. Similarly, the EOJ's Geographic Information System Department was using cartography to support the electoral process.[13]

The Election Information Management System (EIMS) is an extension of the initial system used for the transmission of preliminary results, combined with GIS features. It was developed in 2006 by MONA GEOINFORMATICS,[14] at a cost of (U.S.) $30,000, to provide accurate, real-time information to stakeholders in the election process, including the general public, the director of elections, the Electoral Advisory Committee, candidates, observers, and the media.

The EMIS was designed to perform the following functions:

- Display the times polling stations open and close.
- Display reports on incidents such as voter intimidation, delays, violence, etc.
- Obtain and display results from polling stations, quickly and accurately.
- Provide information graphically, in an eye-catching format.
- Provide an automated, real-time electronic feed for use by the media.
- Allow the general public to have access via the Internet.
- Be able to cover both a national and a local election (even if on the same day).

---

[13]   The file images used were provided by the Land Information Council of Jamaica (LICJ) and, more recently, by Ikonos.

[14]   The company, which belongs to the University of the West Indies, still owns the system source code.

The system was first used in elections in 2007 (September and December), in the Election Centre established for that purpose. (See Figure 9).
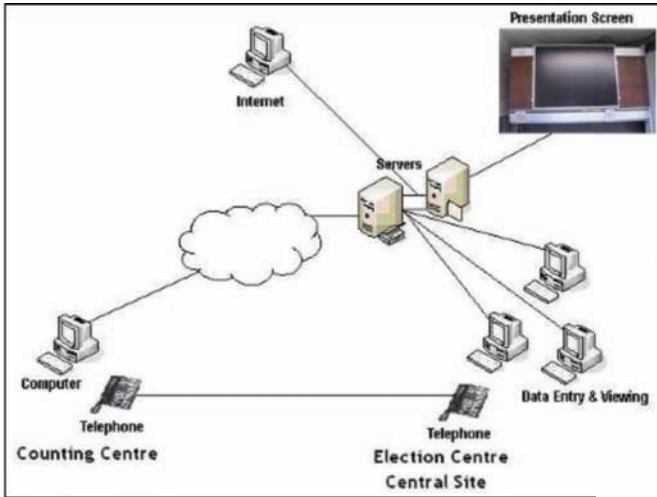

Figure 9: EIMS topography
Source: EOJ

EIMS Features

- **User role management** – administrators, data entry clerks, officials, incident monitors, etc.
- **Data output** – dynamically created text files, updated at regular intervals, accessible to the press and used in media reports.
- **Integrated mapping components** – results, incidents, polling station opening and closing times, declared constituencies, etc.
- **Detailed text reporting** – generated even at the polling station level, at any point during or after the election.
- **Isolation of outstanding results** – outstanding polling stations, electoral divisions, and constituencies.
- **Graphs and charts** – generated down to the polling station level.
- The system also records information on candidates and incidents up until the day of the election.

The interface for displaying results has two components:

- The basic Web interface, available to media outlets that sign a basic contract with the Jamaica Electoral Office, has an interactive map and a link to live results via a file that has text, charts, tables, and graphics.
- The official interface, used to view results and statistics on Election Day, has a map of the process (at the district and constituency level), an at-a-glance statistics panel, monitoring of progress at polling stations, party statistics, and various types of graphics and maps (See Figures 10A, 10B and 10C).

Currently the information provided by the EIMS is entered manually, in the field, by EOJ staff. Its operation takes three or four additional staff members per constituency, in sixty offices (one in each electoral district), plus nine additional officers for the satellite offices.

Strengths and Weaknesses

The Election Information Management System lets election officials know right away which polling stations are late in opening or have not opened in a reasonable time, and indicates any outstanding ballot boxes at the end of the voting day. It collects and tallies preliminary election results quickly, allowing a winner to be declared in a timely manner, and facilitates the dissemination of the results to the media via a format they can easily use for their various platforms.

The EOJ identified human error as the system's main weakness. Information entered by data entry clerks in the field has not always been satisfactory in terms of quality and speed.
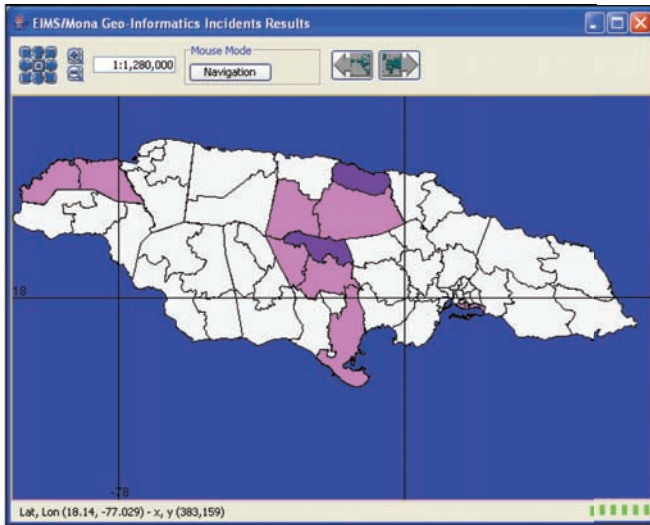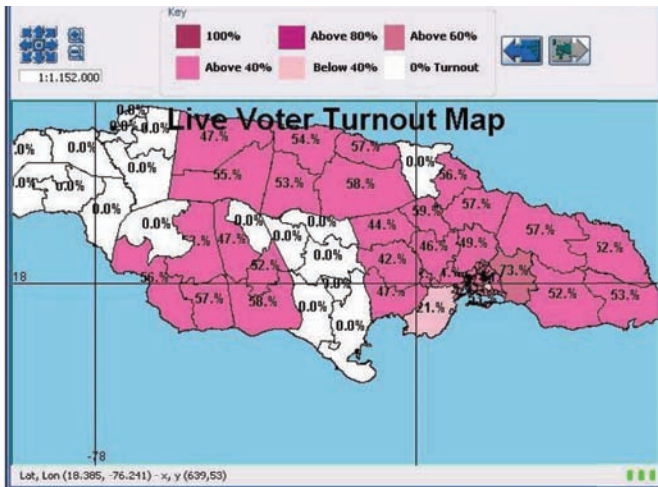
Figure 10A: EIMS incident mapping
Source: EOJ

Figure 10B: EIMS real-time voter turnout report
Source: EOJ
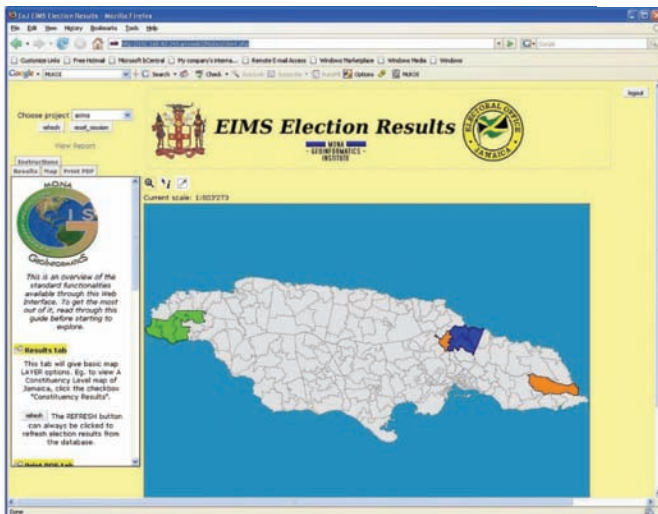
Figure 10C: EIMS Web interface
Source: EOJ

3.3.6 Future Challenges

In the future, the EOJ aims to connect and integrate the EVIBIS and EIMS so that certain information from the election process can be fed automatically in real time into the EIMS, without the need for manual data entry. This would also facilitate having certain information in greater detail (at the polling station level).

To speed up the process of culling the voter lists, the EOJ plans to implement automatic cross-checks with other government databases, such as that of the public health department, in order to purge the names of the deceased. Discussions are ongoing to allow more information-sharing among government agencies.

In May 2008, the EOJ tested a new system for the electronic capturing of fingerprints at regional centers during voter registration. The objective was to recapture poor-quality prints of voters in the database, without the issues encountered in the past. One requirement was to reuse the digital cameras that had already been used to take voters' photos and have the data immediately transmitted electronically to the central site. The EOJ wanted its system engineers to be part of the development process so they would not have to depend on the vendor for all system changes, a lesson learned from experience. The pilot system captured both the photograph and fingerprints, which are verified for quality immediately on collection.

3.4 Mexico

3.4.1 Background

Mexico is a federal state made up of 32 federated entities (31 states and the Federal District), which are autonomous with respect to their internal government structure.

All entities in the federation adopt the "free municipality" as the basis for their territorial division and their political and administrative divisions. Each of the 2,435 municipalities that make up the country is administered by a municipal council elected by direct popular vote. Each council is composed of a municipal president and a variable number of local public officials (*regidores* and *síndicos*).

The Constitution recognizes that elections are the only legally valid and legitimate means for the integration and renewal of the federation's executive and legislative branches, as well as each of the federated entities and the municipal councils.

The Federal Electoral Institute (IFE) was formally created on October 11, 1990. It was the result of a series of constitutional reforms approved in 1989 and the adoption, in August 1990, of regulatory legislation—the Federal Code of Electoral Institutions and Procedures (COFIPE)—that is still in effect and was reformed most recently on January 14, 2008. Legislative representatives, national political parties, and citizens all participated in this reform process.

The IFE is the autonomous public body—independent in its decisions and operations—responsible for carrying out the state function of organizing federal elections, that is, those that involve the election of the president of the United Mexican States and the representatives and senators that make up the Congress. Each state can decide independently how to conduct elections for the municipal councils, as long as the process follows the guidelines established in the electoral law.

The federal electoral process in Mexico was created as an orderly, sequential set of acts and activities regulated by the Constitution and the electoral law, and carried out by the authorities, the political parties, and the citizens for the purpose of periodically renewing the ranks of the legislative and executive branches of the union.

3.4.2 Institutional Framework

The structure for the distribution of powers in the area of elections has two main components:

- First, both the federation and the 32 federated entities have their own rules, institutions, and procedures with regard to elections. There is a clear differentiation and separation of powers in the regulatory arena and in basic functions.
- Second, administrative powers (preparing, organizing, and conducting elections) and those that are jurisdictional (settling disputes and applying electoral justice) are clearly differentiated and are conferred on different bodies for each level of government.

In the federal sphere, administrative powers correspond to the Federal Electoral Institute (www.ife.org.mx), a public, autonomous, and independent body, and jurisdictional powers to the Electoral Tribunal, a specialized body of the judiciary. Unlike the IFE, the Tribunal has the authority to decide certain types of cases and is the highest court for handling local election disputes.

The IFE has its central headquarters in the Federal District, and it exercises its authority across the country through decentralized bodies located in the capitals of the 32 federated entities and in the 300 districts into which the country is divided for electoral purposes.

The IFE is authorized to comprehensively and directly perform the functions that have to do with preparing, organizing, conducting, and overseeing federal elections. This includes reviewing and setting geographical boundaries for elections; generating and updating the

electoral registry; seeing to the rights and prerogatives enjoyed by national political parties and groupings; and creating and implementing ongoing civic education programs.

As part of both its central and decentralized structure, the IFE has three different types of bodies. The management bodies, which take the form of councils, are deliberative decision-making entities responsible for seeing that constitutional and legal standards are applied in the area of elections. The technical-executive bodies, which take the form of executive boards, are responsible for carrying out all the technical and administrative tasks required for preparing, organizing, and conducting elections. The oversight bodies, which take the form of commissions, have authority exclusively in the area of the electoral registry.

The General Council is the highest management body within the IFE. It is made up of nine members with a right to a voice and a vote (the council president and eight electoral councilpersons) and a variable number of members (currently 17) with a voice but no vote. These are the councilpersons from the legislative branch, one for each of the parliamentary factions in the Federal Congress (currently 8); one representative of each of the political parties registered at the federal level (currently 8); and the IFE executive secretary.

The IFE has complete and direct responsibility for all activities related to preparing, organizing, conducting, and overseeing the federal election process, as well as any activities consistent with the IFE's purposes as established by law. Its principal functions include the following:

- Creating and updating the federal electoral registry.
- Periodically demarcating and reviewing election-related geography.
- Registering national parties and political groupings.
- Attending to matters related to the rights and prerogatives of national parties and political groupings, including scrutiny of their resources.
- Setting campaign spending limits.
- Registering candidacies for posts filled through federal elections.

- Designing, printing, and distributing election materials.
- Preparing for Election Day.
- Selecting and training poll officials.
- Regulating electoral observations, opinion polls, and surveys.
- Computing election results.
- Validating and granting documentary certification in the case of elections for representatives and senators.
- Designing and implementing ongoing programs for civic education.

3.4.3   Legal Framework

One important way to resolve specific legal questions related to electoral technology is through the agreements made by the Federal Electoral Institute's General Council regarding modifications to the respective regulation. These agreements complement the laws that are in effect. Below, in chronological order, are several key examples related to the use of technology:

CG199/2000. Agreement of the IFE General Council approving the regulation for the production, maintenance, management, and use of information services and equipment.

JGE 156/2004. Agreement of the IFE General Executive Board issuing guidelines for the publication and management of the Web site of the Federal Electoral Institute.

CG 142/2005. Agreement of the IFE General Council approving modifications to the regulation that establishes administrative guidelines for acquiring and decommissioning equipment and contracting for information services.

CG 204/2005. Agreement of the IFE General Council establishing guidelines for the operation, during the 2005-2006 federal election process, of the databases and information systems of the national computer network (Red-IFE) that will allow for the development and follow-up of activities of the Federal Electoral Institute's central and decentralized bodies.

CG 489/2008. Agreement of the IFE General Council establishing guidelines for the operation, during the 2008-2009 federal election process, of the Red-IFE databases and information systems that will allow for the development and follow-up of activities of the Federal Election Institute's central and decentralized bodies.

JGE 83/2008. Agreement of the IFE General Executive Board modifying guidelines for the publication and management of the Federal Election Institute's Internet and Intranet portals.

In order to have preliminary election results available as soon as possible at the national level, the law authorizes the IFE Executive Secretariat to establish a mechanism for the integration of results and their immediate dissemination to the General Council. Councilpersons and representatives of political parties accredited to the General Council would have ongoing access to the system.

The law also authorizes the General Council President, subject to agreement by the General Council itself, to order any pertinent studies or procedures in order to determine election trends on the day of the voting. These results may be distributed only with the authorization of the IFE's highest management body.

However, the application of information technologies to the electoral process is limited by the fact that election laws in Mexico, for historical reasons, tend to stipulate in great detail each process that must be followed on Election Day. This makes any change difficult, since it first has to be approved by Congress. While this is seen as something of a disadvantage, it is also widely recognized that it is this law, with all its demands, that restored the faith of Mexican citizens in their electoral system during the 1990s.

There is greater flexibility, by contrast, at the level of the federated entities. The chart on the following page is a list of regulations and laws in some of the entities with respect to the use of technology in the electoral process.

3.4.4 Federal Voter Registry

The federal voter registry was the first system in Mexico that used information technologies extensively.

As part of a series of election reforms adopted from 1989 to 1996, the IFE was created as an independent institution with the aim of restoring citizens' confidence in the electoral system. Since the electoral registry in use until that time suffered from a similar lack of confidence, it was decided to create a new registry from scratch. Using total census techniques, the new registry was created in only eight months, from November 1990 through June 1991. This type of effort would not have been possible without information technologies.

By the end of 1992, 17 regional computing centers had been created. Since then, high technology has been used mainly for the production of the photo ID for voting (voter card) and in the processes set up for updating and culling the registry itself (the system for permanently updating the registry, called the SAPP). Processes originally done by hand were replaced by automated ones.

The operating structure from 1991 to 2001 was the following:

- Processing would begin at a citizen assistance office, where the person in charge filled out a form with the citizen's information. The form was sent physically to the regional computing center.

- The regional center would capture the data from the form for citizens who were either registering or updating their information in the electoral registry.

- The data was captured through the system set up for updating the voter registry. In cases in which a citizen was registering, the SAPP verified that he or she was not registered more than once, and in cases involving corrections, such as address changes, the system would validate and update the information in the database. The information would be sent from the national computing center to the respective regional centers.

- The cycle of updating the voter registry would be completed when the citizen's images (photo, signature, and fingerprint), incorporated into a receipt, were digitized at the corresponding regional computing center, updating the image database.

Baja California	Law of Electoral Institutions and Procedures	Article 145—The General Council shall have the following powers: …. XXXI. To order the preparation of plans and studies in order to analyze the viability of other forms of electoral organization and voting designed to facilitate the process on Election Day and make it more efficient through the use of new technologies, without compromising the authenticity and secrecy of the vote, and to approve these where appropriate; Article 159—The Executive Office of Electoral Processes has the following powers: …. VIII. To prepare preliminary plans for studies to analyze the viability of other forms of electoral organization and voting designed to facilitate the process on Election Day and make it more efficient through the use of new technologies, without compromising the authenticity and secrecy of the vote;
	Law of Citizen Participation	Article 58—The Institute, through its competent governing bodies, shall prepare a plan for holding plebiscite or referendum processes, to be approved by the Council. Such a plan could contemplate the use of new technologies for its organization and for the voting, including the installation of voting centers. The implementation of this technology may be authorized only provided that the authenticity and secrecy of the vote is guaranteed.
Coahuila	Law of Political Institutions and Electoral Procedures	Article 171—The vote may be collected by means of electronic instruments and/or machines whose model is approved by the General Council, provided that the effectiveness and secrecy of the vote is guaranteed.
Federal District	Electoral Code of the Federal District	Article 95—The General Council has the following powers: …. XXIII. To approve the features of the elements that will permit the use of electronic tools to exercise the vote. Among those that should be considered are electronic tools for collecting votes, election software, and where appropriate, tools that make it possible to maintain the secrecy of the vote. For these purposes, the Institute may enter into agreements with academic institutions for the necessary technical support, or with private persons for the acquisition of the respective electronic tools. It must also approve the electoral sections of the law under which electronic tools may be used for exercising the vote;
Michoacán	Electoral Code of the State of Michoacán	Article 286—Citizens of Michoacán who meet the requirements to vote in accordance with this register may ask to be included on the list of Michoacán voters abroad on an individual basis. The Michoacán Election Institute will make the necessary plans so that, 180 days before the beginning of the electoral process, interested citizens may obtain their registration application by any of the following means: I. At the offices of the Michoacán Election Institute; II. At Mexican consulates and embassies; III. By electronic means; and IV. Other means agreed to by the General Council.
Nayarit	Electoral Law of the State of Nayarit	Article 77—The State Electoral Council shall have the following powers: …. XXIII. To analyze the viability of the use of new technologies on election day;
Sinaloa	Electoral Law of the State of Sinaloa	Article 56—The State Electoral Council shall have the following powers: …. XXXIV. To order the preparation of plans and studies in order to analyze the viability of other forms of electoral organization and voting designed to facilitate the process on election day and make it more efficient through the use of new technologies, without compromising the authenticity and secrecy of the vote, and to approve these where appropriate;
Tlaxcala	Code of Electoral Institutions and Procedures for the State of Tlaxcala	Article 195—The Office of Electoral Organization, Training, and Civic Education shall have the following functions and powers …. XII. To prepare draft studies on the viability of other forms of electoral organization and voting designed to facilitate the process on election day and make it more efficient through the use of new technologies, without compromising the authenticity and secrecy of the vote.

- These images were obtained when the citizen picked up his or her voting credential at the citizen assistance office. At that time, two sets of instant photos (with security elements) were issued, along with the citizen's signature and fingerprint, which were incorporated into the credential and the receipt.

- The database of the electoral registry was distributed to each of the 17 regional computing centers (There was also a national computing center). Each regional center stored the information on all citizens who were residents of the federated entity under its jurisdiction, and the national computing center did a validation so that no citizen would be able to register more than once.

- Each regional computing center was connected through a private communications network for the purpose of sending changes and the validations of these changes to the national computing center.

- The image database was also distributed to each of the 17 regional computing centers.

At that time, the system used a combination of elements developed internally (fingerprint readers) and standard formats (JPEG images). The databases were stored on optical disks that were cutting-edge technology at the time.

These databases were used to produce the photo ID used for voting and to generate the list of names and photos (voter registry).

A system was also created for consulting the image database for the purpose of culling the voter list (a process for detecting duplicates or the same names). This involved conducting a general review of the registry database to look for citizens who, based on their names, might be registered more than once. Once the names of possible duplicate registrations had been mined, a search was done of the image database using the voter's code, and low-resolution images of these candidates were printed out. A visual check was then done to see whether the possible duplicates were the same person or if they were different individuals with the same information.

At that time, biometric technologies for identifying possible duplicates were not yet in use.

Evolution of the Electoral Registry

Although the system used cutting-edge technology for its time, various problems arose that led to a modification of the technology being used. These consisted mainly of the following:

- **Long processing times** between the collection of information from a citizen and the updating of the registry and delivery of the voting document (between 30 and 40 days).

- **Theft of documents** before they were given to the citizen. This was because the citizen's photo and fingerprints were not added until he or she picked up the credential. When the credential arrived at the citizen assistance office where the person was registering, it contained information on the voter but no photo or fingerprint. At the time the credential was given to the citizen, two photos were taken—one affixed directly to the credential and the other kept to be scanned and incorporated into the image database. A similar process occurred with the fingerprints. Thus the "blank" credentials became a popular target for thefts, used to create false identities for illegal immigrants and criminals.

- **Difficulties in identifying duplications** in the database. The system needed indications such as similar names to be able to identify possible duplications. Then the images of these candidates for duplications had to be compared visually to see whether it was the same person.

- **Risk of system failure**. Since there was no high-tolerance system with backup equipment in place, a malfunction of the main equipment meant that computer services were unavailable until the equipment was repaired.

The system was gradually modified between 2000 and 2006 to address these weaknesses. To reduce processing time, the citizen assistance offices were connected directly to the IFE's private network, which made it possible for the captured data to be transmitted directly and electronically. Previously, only the voter registry's 300 district centers had been connected to the network, which made it necessary to manually transport documents from the citizen assistance offices to the district centers. With this change, the time between application for and delivery of a voting credential was reduced to an average of 10 working days.

In addition, the process of capturing the photo and fingerprint was changed in order to stop the theft of credentials. Under the new process, the citizen's photo and fingerprint were taken digitally at the time of registration and incorporated during the production of the credential. Thus the credential would arrive at the citizen assistance office complete and ready to be picked up by the voter, with very limited use to anyone else since it was difficult to alter.

To make the search for duplicates easier, a "vector" system was implemented for the image database. A unique code was generated in the database for each photo and each fingerprint; this permitted an automated comparison of faces and fingerprints (biometric identification). This made it possible for permanent scanning and identification of possible duplicates, and for subsequent purging if a duplication was verified.[15]

With the implementation of new technologies at the citizen assistance offices, the system for updating the voter registry was also redesigned, as were systems for administration and automated electoral mapping, and the system to handle the migration of data from the image database, the citizen's electronic registry, and the

online backup database. These modifications as a whole have evolved into the creation of the new integrated information system of the federal voter registry (SIIRFE), which was released in 2003 in a preliminary version and which has continued to evolve to meet institutional needs (See Figure 11).

Currently, the SIIRFE has three types of offices that provide assistance to citizens:

- District and fixed offices. These are found at the IFE district offices and at certain other strategic points. They have online access to be able to transmit and receive information directly from the institutional communications network, or Red-IFE.
- Semi-fixed offices. These are mobile offices adapted and equipped for land vehicles. They conduct regular rounds to assist citizens in various localities.
- Mobile offices. These have a basic configuration of portable equipment. They assist citizens who live in hard-to-reach communities.

Each citizen assistance office has the following infrastructure: personal computer, printer, signature pad,

Figure 11: Components of the integrated information system of the federal voter registry
Source: IFE

---

[15] An improvement to the subsystem was implemented in 2003. It kept the functionality of the face comparison, but now also performs a fingerprint comparison through an automated fingerprint identification system. This subsystem in the short term will permit identification of possible duplicates from the moment a citizen does any registration-related paperwork at the citizen assistance office.

fingerprint pad, digital camera, barcode readers, and communications equipment (See Figure 12).

Figure 12: Equipment for the citizen assistance office
Source: IFE

The SIIRFE server is a high-performance, high-tolerance piece of equipment, since it can be guaranteed to operate continuously and has redundant components. Its capacity can be upgraded to handle operational needs, and latest-generation technologies can be added and can function alongside the existing systems and equipment. The server is modular, as its components can be replaced without having to modify the entire system. It is secure, since it has the capacity to implement architectures that help control and manage access to services. It is also adaptable and can evolve to accommodate new technologies, so its components can be kept up-to-date.

The server is used to provide the various services required by the SIIRFE subsystems. These involve updating the electoral registry and the voter lists; consulting voter registry information; culling the registry as a preventive or corrective measure; mining for statistical information; and updating election maps. The high-performance equipment guarantees levels of service that make it possible to carry out activities and tasks in a timely manner, and above all it allows for continuity of operations.

High-Tech Credential

High technology is used not only for the registry, but also for the production of the credential itself. From the outset, the IFE has incorporated successively more security measures, making it much more difficult to falsify the voter ID. The latest 2008 version of the credential has security mechanisms as shown in Figure 13.

Election Mapping

The Federal Electoral Institute generates election maps on an ongoing basis, and its products are updated every semester.

The IFE and the Internet search engine Google signed a cooperation agreement to make it easier for citizens to locate the polling station where they were to cast their ballots in the local and federal elections held on July 5, 2009. The IFE posted its election maps on Google Maps, and the IFE's Committee on Electoral Organization and Training managed the process of continually upating location data for the more than 139,000 polling stations across the country (See Figure 14).

3.4.5 Preliminary Election Results

Since 1994, another area in which the IFE has used new technologies on a massive scale is in its Program for Preliminary Election Results (PREP). This is a mechanism used to provide timely information to the Institute's General Council, political parties, the media, and citizens in general on the preliminary results of federal elections. This is done through the capture and publication of the data from the tally sheets that come in to the data collection and transmission centers—called CEDATs—located at each of the country's more than 300 district executive offices throughout the country.

It should be noted that this is not a sample quick count, since the results are calculated based on the totality of votes, not a partial sample.

For the PREP, the first copies of the original tally sheets (*actas*) containing the results of the count done at each polling station are taken to one of 300 CEDAT locations; there is one center for each electoral district. Each center compiles, captures, and transmits the data collected from the polling stations (also from the 300 polling stations
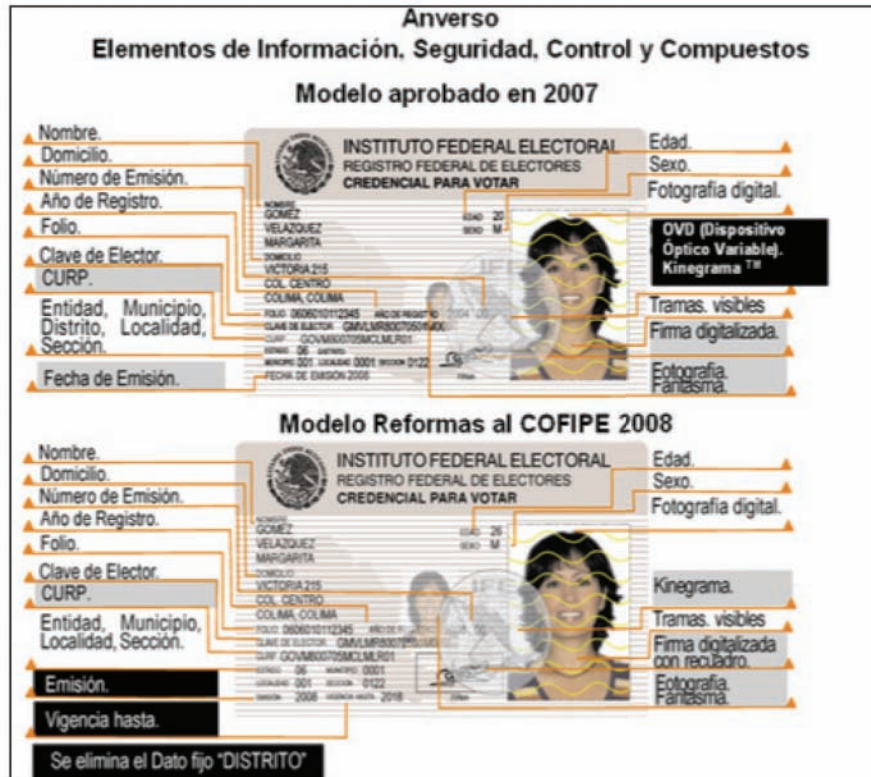
Figure 13: New model for the voter ID
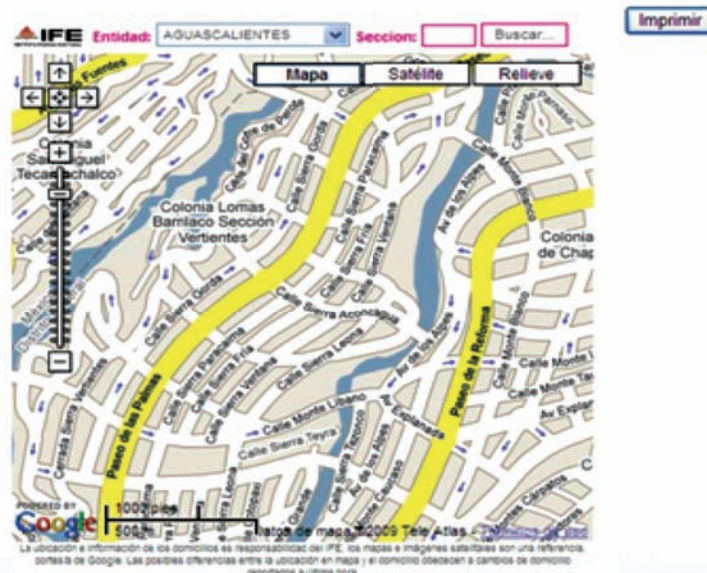Source: IFE

Figure 14: Location of voting center using Google maps.
Source: IFE

installed for Mexicans living abroad), and this data is transmitted electronically to a computing center where it is tallied and published. There are two national centers that collect preliminary election results; one functions as the main center and the other as a backup (See Figure 15).

The technology used to capture and transmit results has its roots in the banking system, since it uses terminals—called remote customer terminals (RCTs)—that were designed for making credit card payments. The latest of these devices have the following features:

- TCP/IP operating protocols (Transmission Control Protocol/Internet Protocol).
- Security standards for the type of electronic transactions used in banking.
- Activation with individual magnetic cards.
- Inviolable; deactivate if opened.
- Capacity to issue a receipt for each tally sheet captured (integrated thermal printer).
- LCD screen (liquid crystal display).

- Numerical keyboard, function keys, and access keys.
- Internal modem for data transmission.
- Security: SSL v3.0, 3DES encryption, file authentication with VeriShield (a mechanism for protecting credit card and debit card data).

The application that runs on the terminals was developed by IFE technicians. The program makes it possible to record the information contained on each tally sheet, provides the mechanisms for validating and storing the data on the RCT, and sends that information to the program's central system.

The data collection centers operate on a local network and are connected by a switch to a router. This transmits data to the Red-IFE network via a modem or network termination unit (NTU). Transmissions by modem use the public network, while NTU transmissions use the IFE's private network (See Figure 16).

With respect to network security mechanisms, there are access controls at the network level (segmented networks,
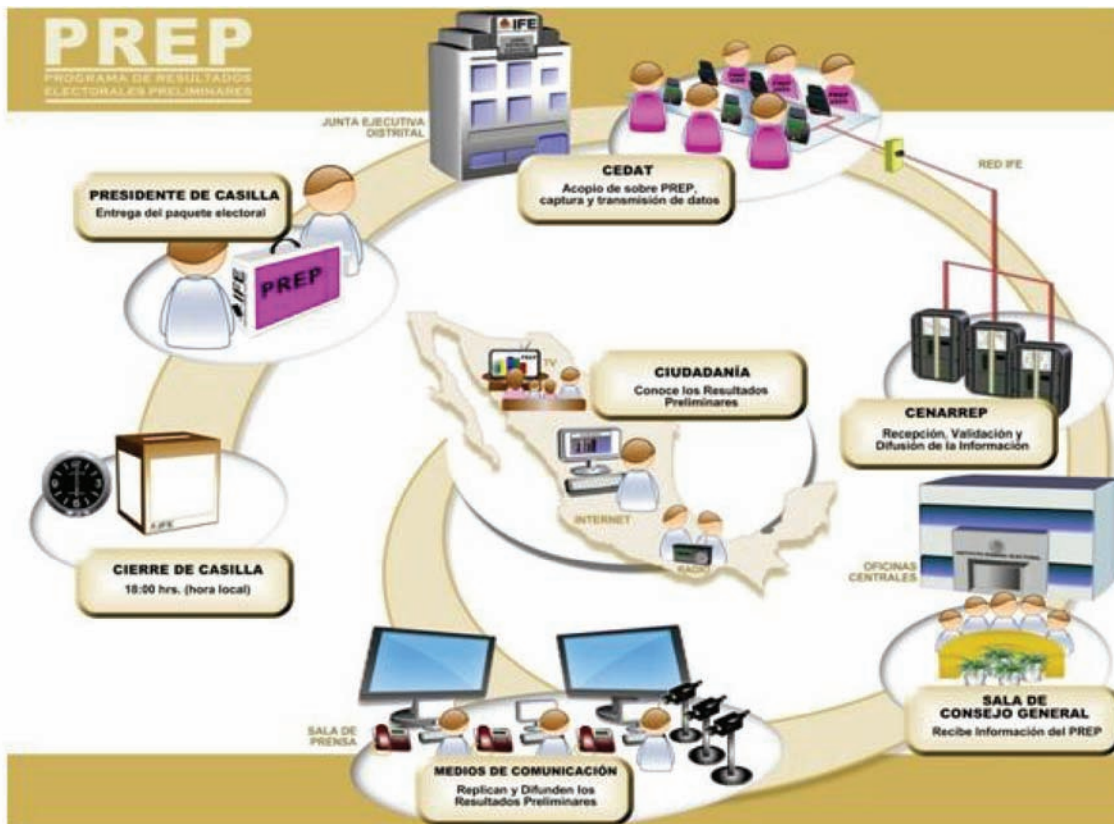

Figure 15: PREP 2009 operating structure
Source: IFE

firewall protections, demilitarized zones, validation of Media Access Control addresses, and intrusion detection systems); protections against malicious codes (anti-virus); and external security audits (intrusions through ethical hacking, vulnerability analysis).

In terms of the computing centers, there is security for the communications devices (intrusion detection systems, redundancy, package filtering, restrictive policies, virtual networks, use of best practices); the servers (widely available clusters, traffic filtering, use of best practices); and the database servers (replication of data, proactive monitoring, configuration based on best practices).

The CEDATs have set up security for communication devices (logical segmentation, encoded channels, controls against attacks and denial of service); remote customer terminals (proprietary system, inviolability of the device, encryptically signed code); and the capture process (authentication, double capture, tracing audit, symmetrical codes with 192-bit AES, transaction signatures).

District computing centers use the "https" protocol (a secure protocol for sending hypertext via the Internet). Information is sent using the SSH protocol (which creates a secure tunnel for sending data), all transactions are registered in a logbook, and backup versions are created.

Finally, with respect to physical security, the computing centers have the following features:

- Precision air conditioning system.
- Uninterrupted power supply.
- Emergency generators to guarantee continuity of electric power.
- Access control system using biometrics.
- Fire extinguishing system.
- Closed-circuit television system.
- Security guards on the premises 24 hours.

PREP Modules

The PREP system's central application module establishes communication with the remote customer terminals, processes the transactions it receives from them, and ensures the integrity, authenticity, and confidentiality of
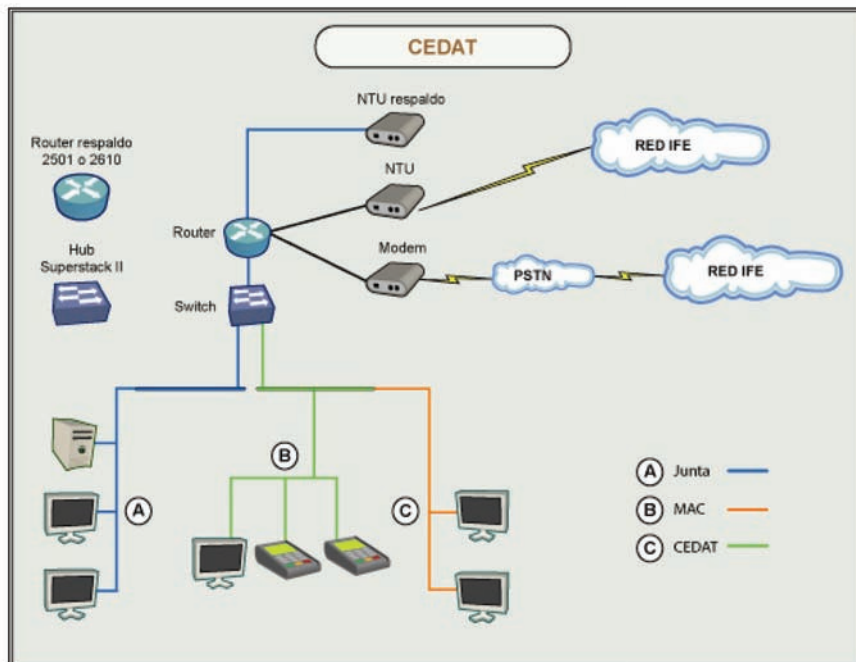

Figure 16: CEDAT setup
Source: IFE

the information received. It also has a tool for monitoring the status of the connection and processing from each of the connected RCTs.

The extraction and publication module generates and distributes each of the reports on preliminary results to the General Council, the Press Center, and the institutions disseminating the information on the Internet. This guarantees that each batch of information will be posted at the appropriate time and place, without interruption, throughout the publication of results.

Both the PREP and the district computing centers allow for the publication of disaggregated information at the polling station level.[16]

The dissemination of results to citizens is done through service providers and institutions that post the information on their various Web sites. Thus, traffic is not focused solely on the IFE page, but is distributed through the infrastructure of various providers. In 2006, 28 institutions participated in the dissemination.

All information related to the results shown by the PREP is at the disposal of citizens via the IFE Web site, including the databases that contain results by party at each polling station.

In the 2006 elections, 45% of the tally sheets, or *actas*, had been captured by midnight, and 78% of the total had been processed by 2 a.m. Ultimately, the PREP managed to capture 98.45% of the *actas*. A certain number of them do not reach the CEDATs, perhaps because of large distances between some polling stations and data collection centers, or because the copy of the tally sheet was not included in the PREP envelope.

In the 2009 elections, 62% of the *actas* had been captured by midnight, and ultimately the PREP was able to capture 99.87% of them.

Weaknesses of the PREP System

One weakness of the PREP system has been that its source of information is the vote tally sheets, which frequently contain errors made by poll officials when they count the votes by hand. For example, occasionally the number of ballots that are counted and recorded on the tally sheet does not coincide with the number of individuals who cast their votes at the polling station. This error is due to the manual system of stamping a mark on the voter list next to the name of each person who cast a ballot. Some of those marks could be omitted during the vote count (blank box) due to involuntary error or fatigue, given the long voting days.

Similar human errors may cause valid polling stations results to be challenged, and could also lead to polling stations with real irregularities being overlooked. Since there is little confidence in the totals recorded on the tally sheets, in the event of irregularities these may come to be ignored as errors in the *actas*, assuming that the number of ballots does, in fact, coincide with the number of voters who cast their ballots at that polling station.

While there are approaches being considered to eliminate human error in the tallying process at the polling stations through the introduction of more technology—specifically through automation (electronic voting)—Mexico's electoral law does not allow election procedures to be changed without prior legislative changes. This has put the brakes on plans for electronic ballot boxes.

Another weakness that was particularly evident in 2006 was the confusing way the PREP dissemination program displayed and differentiated between the percentages of tally sheets that were valid and those with inconsistencies, out of the total number processed. This led to tensions and conflicts at the time.

Evolution of the PREP System

The first program for transmitting preliminary results was introduced in 1994. Since then, the system has undergone a process of modification, with improvements made to its performance and reliability. The current system:

---

[16] The difference has to do with the fact that the PREP operates on the same night as the election and transmits information to the public, while the district computation process takes place the day of the official tally, and the information is not transmitted in real time to the public.

- Incorporates relational databases instead of files.
- Uses banking terminals, capable of transmitting using TCP/IP protocols (previous systems did not use this protocol).
- Uses a high-tolerance approach for all layers and processes, including the database.
- Uses the standard 192-bit AES (Advanced Encryption Standard) symmetrical code instead of the DES standard (Data Encryption Standard), which has been shown to be vulnerable.
- Has developed various processes based on ITIL best practices (Information Technology Infrastructure Library).
- Has graphic, dedicated monitoring of each of the remote capture terminals.
- Has online monitoring of each data collection and transmission center.
- Includes publication of the results of votes cast by Mexicans living abroad.
- Uses a Rational Unified Process (RUP) to develop documentation.
- Digitizes the *actas* and publishes images on the IFE Web site, using the MD5 (Message Digest 5) algorithm for cryptographic reduction in order to guarantee the integrity of what is being displayed.

Innovations for the 2009 Elections[17]

Compared to the 2006 PREP, the following improvements were made for the 2009 elections:

- A clearer, more didactic program for preliminary election results.
- Publication scheme in which the PREP posted the information contained in all the tally sheets collected.
- In the case of inconsistencies in an *acta*, clear indications of this were included on the publication screen.
- Horizontal navigation route that provided citizens with better access to different levels of information (nationwide, by constituency, entity, district, and section) through pull-down menus from the start screen.
- Database: All information included in a single database.

- Explanatory captions: Publication screens with text explaining the information displayed.

Audit and Certification of the PREP System

The National Autonomous University of Mexico (UNAM) conducted an audit of the PREP 2009 information system that included the program's security and operations, and checked that the software that was designed was the same that would be used on Election Day.

The PREP Technical Advisory Committee (COTAPREP) made up of academics from Mexican universities and representatives of civil society, advised on the implementation and operation of the mechanisms and infrastructure needed to carry out the program for preliminary election results. It also collaborated by preparing analyses, studies, and proposals on developing and optimizing the program. However, the COTAPREP does not have a binding vote in the development of IFE systems; its role is simply advisory.

For the 2006 elections, the PREP needed 4,104 people for its operations, the majority of whom worked in information capture. In addition, 2,170 terminals were used, each of which cost approximately (U.S.) $200. The total cost of the PREP for that year was estimated to be close to (U.S.) $10 million.

3.4.6 Computation of Results

The system for the official computation is technically separate from the PREP, but it uses the same tally sheets from the polling stations as its source of information.

The computation system that operated during the 2005-2006 federal election process consisted of three versions:

- District board version.
- State version (each federated entity has what is called a *junta local ejecutiva*).
- Version for central offices.

In addition, a contingency version was developed. It operated under a central scheme, in case one of the district boards were to have problems in operating the system on the local server.

---

17   On July 5, 2009, Mexican citizens elected 500 federal deputies, 6 governors, 568 municipal presidents, 16 heads of delegations, and 433 local legislators.

During the session to count and compute the votes, the system operators captured the results of the voting from the polling stations in each district, as recorded on each tally sheet or *acta*. Every five minutes they executed a consolidation process, transferring information from the databases of the 300 districts to the servers at the central offices.

At the end of each cycle in the consolidation process, a centralized process was performed; this generated statistical reports, graphics, and plain text archives that could be consulted by users in the central offices. To be able to access information captured in the system, the state boards connected directly to the central server; that way, they could consult the information captured by all the district boards in their state.

Two days after the operation of this district system, the executive state boards from each electoral region (*circunscripción*) conducted the computation for that region. The information was captured in each server used by the state board; this information was consolidated every five minutes in the central servers, replicating the same operating scheme used for the district tally.

The version at the district board level is the one with the highest system functionality. This version included modules to perform the following functions:

- Capture of results of the presidential election.
- Capture of results of the election of deputies, based on the principle of relative majority.
- Capture of results of the election of deputies, based on the principle of proportional representation.
- Capture of results of the election of senators, based on relative majority.
- Capture of results of the election of deputies, based on proportional representation.
- Data capture for generating tally sheets and documentary certification.
- Module for printing tally sheets and documentary proof.
- Module for statistical reports.
- Module for graphics.
- Module for generating archives in plain text.

In general, both for the PREP and for the final tally of results, information technology was introduced early on and developed continuously over many years; thus the IFE has accumulated significant human capital for its management. The Federal Electoral Institute employs between 30 and 40 software developers on a permanent basis and has managed technology projects since 1994. The IFE always tries to obtain the rights to software and train institution staff, in order to avoid dependence on technology providers and build its own capacity.

3.4.7 Electronic Voting

The IFE's plan for an electronic ballot box is not yet feasible as of this writing, since current federal laws do not permit its use. The development of the electronic ballot box was begun in 2005 and its future is uncertain.

The principal aim is to make strides in the certainty and accuracy of the tally done at the polling stations and to speed up the transmission of results. The former arises from the difficulties with *actas* with inconsistencies at many polling stations. It is also hoped that electronic voting will reduce the total cost of elections.

At the outset of the project, the expected requirements were the following:

- Easy for poll officials to manage.
- Easy to install at the polling station.
- Light and easy to transport, even to distant sites.
- Easy to use for voters from any social or educational background.
- Trustworthy for voters and political parties.
- Secure in the computation of votes at the polling station.
- Capable of allowing manual verification of vote tallies.
- Capable of being audited using a computer.
- Capable of operating with its own energy source (battery).
- More economical (in the medium term) than the current voting procedure.

In terms of the design of the ballot box, the prototype that was developed is geared toward sturdiness and simplicity. For example, instead of using complex audio systems to

guide blind voters, it uses Braille. The mechanisms to control the ballot box are simple mechanical interrupters—not touch screens, which have recently become popular . The price of each ballot box is estimated at approximately (U.S.) $500, a positive factor when compared to the latest touch-screen machines or optical devices (See Figure 17).

Figure 17: Prototype of an electronic ballot box
Source: IFE

The ballot box would maintain a design similar to that of a ballot, allowing the citizen to identify the different types of election through the various ballot models and through lighted signals. The machine would be manufactured with light materials to facilitate storage and transport.

The plastic display panel would contain the logos of the political parties participating in each electoral process, with space for unregistered candidates and space for blank votes. The names of the relative-majority candidates would be printed on this display panel; the names of the proportional-representation candidates, meanwhile, would be printed on placards posted inside the portable voting booth.

The Braille display currently used at the polling stations would be redesigned so it could be incorporated into the voting machine. A Braille instruction sheet would also be designed for citizens with visual disabilities.

The machine would be activated with the push of a button, and the LCD screen would indicate that the machine's

memory was blank and would print out a voucher to that effect. This is one form of auditing the memory content.

The ballot or display panel citizens use to choose a political party would include security measures. It would also have a mechanism to secure the base so that it could not be stolen or intentionally changed.

Once the voter made his or her selection for each post up for election, the machine would automatically issue a voucher documenting how the person had voted. This voucher would be deposited, also automatically, in a transparent, closed ballot box.

The expected benefits of the system, according to those who developed it, are that it:

- Eliminates the need for printing election ballots beforehand, as well as some of the *actas* now in use.
- Substitutes the procedure for receiving electoral ballots at the district council (counting, sealing, and wrapping) with a protocol in line with electronic voting machines.
- Decreases the printing of complementary documents.
- Lowers storage costs for election documents and materials in the central warehouse, as well as transportation and distribution costs.
- Eliminates the counting and tallying process that currently takes place at each polling station.
- Eliminates errors in counting and computation.
- Eliminates votes considered null due to errors, since the system allows for only one option to be selected.
- Eliminates the use of markers.
- Does away with extra ballots, which eliminates the step of having to nullify them.
- Eliminates illegibility in the tally sheets.
- Modifies the integrity of the electoral package.
- Changes the process carried out by the district councils for capturing preliminary results and doing district tallies.
- Gradually eliminates the PREP and quick counts.
- Implies minimal changes to the current procedure to vote in federal elections, as it requires very little time for electors to cast their votes. They

merely push a button indicating the emblem of their choice, as many times as there are posts up for election.

- Is simple to use and does not disadvantage, inhibit, or discourage voters with little schooling or knowledge of electronic machines or computers, or elderly voters.

One advantage of the prototype is the machine's simple construction. The absence of connection ports for peripherals (such as USBs) should protect the machine from certain types of potential attacks, which paradoxically are more feasible in more complex designs. The fact that the machine's source code is small, due to the absence of complex interfaces and special features, should make it relatively easy to audit.

However, one weakness in the prototype is the lack of a mechanism to cancel a vote (either electronically or by invalidating the paper voucher) if what is printed out on the paper does not coincide with the buttons that were selected.

Internet Voting

This option was evaluated so that Mexicans living abroad could vote. In 1998, a group of experts presented six technical options to enable voting abroad. As of 2005, 16 initiatives had been presented. Ultimately, however, no technical solution was approved, and in 2005 the only option approved was to vote via the postal service, using a valid, current IFE credential.

Electronic Voting in States

Some states in Mexico—specifically the Federal District, Coahuila, and Chiapas—have moved forward in implementing electronic voting through pilot projects.

Since the states have their own laws governing elections, they can generally move forward more easily in implementing the changes needed to be able to introduce electronic voting. In the 2009 elections, the Federal District used machines for casting binding votes at 10% of the polling stations. The principal aim was to increase the speed of the voting process, to go from 3-4 minutes using paper ballots to 45-50 seconds using an electronic ballot box.

One voting machine model has already been tested extensively in recent years. The design is the result of a competition among several university teams. The current model was created by bringing together the best design elements of three different machines. The model type is that of a direct electronic record with a paper voucher printed out. The machine has a touch screen and is based on a reduced Linux platform. The cost is close to (U.S.) $3,000 per machine, which is somewhat high mainly because of the components used.

3.4.8 Challenges

The federal voter registry will continue to improve its technological and operational modernization program and will implement a quality control system, in accordance with the ISO 900: 2000 International Standard.

Plans are also underway to substitute the so-called "03" voter credentials (these are the first versions, issued from 1992 to 2001; voter IDs no longer have a space in which to mark whether a person voted). The "03" credentials will not be valid for the 2012 federal elections, but will be substituted for new credentials that incorporate new technology elements for greater security.

Other challenges include the need to continue culling the electoral registry on a permanent basis, and to continue establishing, integrating and updating electoral maps.

In terms of electronic voting, one challenge is to continue to improve the prototype of the electronic ballot box so that in the future, when the law allows for it, electronic voting could be considered as a way to help eliminate the current human error during the vote count at the polling stations.

3.5 Peru

3.5.1 Background

Peru's National Electoral Board (JNE) was created in 1931 as the only institution dedicated to electoral matters, recognized as the country's election authority. In 1993, the organization of elections was reformed in accordance with the new Political Constitution. Before the reform, the JNE was the only electoral body, and it was in charge both of administrating elections (planning, organizing, and carrying out the electoral process) as well as handling judicial issues (settling election-related disputes). In that sense, it was similar to various Latin American election "tribunals" or "courts" that concentrate all election-related functions.

The 1993 reform created an "electoral system"[18] with three autonomous bodies: the National Electoral Board (JNE), the National Office for Electoral Processes (ONPE), and the National Registry for Identification and Civil Status (RENIEC). The Constitution assigned to each of these bodies different areas of jurisdiction in electoral matters, with the majority of functions concentrated in the electoral body that had been in place before the constitutional reform, the JNE. The 1993 Constitution and the laws developed under its framework attributed the powers and functions outlined below to each of the constitutionally autonomous electoral bodies.

This new structure aimed to modernize the electoral system, and among the new institutions' responsibilities was to gradually introduce the use of technology into the electoral process. It is worth noting that the new bodies entered into operation beginning in 1995.

3.5.2 Institutional Framework

As mentioned previously, the Peruvian electoral system is made up of three institutions, which operate autonomously and coordinate among themselves, in line with their areas of authority.

- **The National Electoral Board** is responsible for overseeing the legality of the process, administering justice in the area of elections, creating and maintaining the registry of political parties, registering the lists of candidates in each electoral process, determining electoral-administrative districts for elections and popular consultations, handling election-related education, and declaring election results. It is also able to introduce initiatives for new legislation. The JNE's highest decision-making body is made up of five members who represent: the Supreme Court (this person chairs the JNE); the Board of Supreme Prosecutors; the College of Attorneys of Lima; the faculties of law of public universities; and those of private universities. Members are elected for a period of four years. During an electoral process, the JNE establishes temporary decentralized bodies called special electoral boards (**www.jne.gob.pe).**

- **The National Office for Electoral Processes**, created under the 1993 Constitution, has the task of organizing all electoral processes. It is responsible for preparing and designing the voter card, as well as delivering the material needed for the vote count and dissemination of results. It provides ongoing information on the tally of election results. It receives the electoral registry, organizes the election, carries it out, and consolidates the final results. Its head

---

[18]   Article 177 of the 1993 Constitution uses the term "electoral system" to refer to the electoral bodies as a whole. This usage is inappropriate, since it does not correspond to the scientific juridical and political concept of an electoral system. As Dieter Nohlen has stated, the concept of the electoral system, "in its restricted—and strictly scientific—sense, refers to the principle of representation that underlies the technical procedure of an election, and the procedure itself by which electors express their political will through votes that then turn into political seats or political power" –Inter-American Institute of Human Rights, Electoral Dictionary, Volume II, San José, Costa Rica, p. 1,158. That is to say, the electoral system consists of a set of principles and procedures by which votes are converted into seats or government posts.

is appointed by the National Council of Magistrates for a four-year period which can be renewed. During each electoral process, the ONPE sets up temporary Decentralized Offices of Electoral Processes (**www.onpe.gob.pe).**

- **The National Registry for Identification and Civil Status**, also created under the 1993 Constitution, is responsible for registering births, marriages, divorces, deaths, and any other acts that could modify a person's civil status. It prepares the electoral registry and keeps it updated. It also provides the JNE and the ONPE with the information they need to carry out their functions. It maintains citizens' identification records and issues IDs certifying their identity. The head of the RENIEC is appointed by the National Council of Magistrates for a four-year period which can be renewed (**www.reniec.gob.pe).**

The three aforementioned bodies apply technology to varying degrees in their respective activities, from the creation of the electoral registry to the publication of the final results.

Since the ONPE and RENIEC began their operations (not until 1995), an accelerated and profound automation of the electoral process has been taking place, largely as a result of the electoral bodies' specialization. In terms of the RENIEC functions, for example, a new, modern system for the identification of citizens was established, as well as a much more technical and secure voter registry. Moreover, that body is in the process of implementing a plan for electronic voter IDs and digital signatures.

In terms of the ONPE, practically every stage of the electoral process has been automated; the only aspect still pending as of this writing is the automation of the act of casting a ballot itself, or electronic voting. However, there is still a legal vacuum on this issue, which must be filled before electronic voting can be implemented.

3.5.3 Legal Framework

With regard to the use of technology in the electoral process, Peru's Organic Law on Elections (in effect since 1997) includes the following mentions.

Article 203: "The electoral registry shall record the names and surnames, the unique identification code of those registered, a digitized photograph and signature of each person, the names of the district, the province, and the department, and the number of the polling station."

Article 205: "Every time an election is convened, the National Registry of Identification and Civil Status shall provide the National Office for Electoral Processes with an updated electoral registry of the polling stations, via a magnetic medium."

Thus, an implicit reference is made to the use of digitization (the conversion of information to zeroes and ones that can be processed and stored by a computer) and the magnetic medium (used to preserve digitized information) in the preparation of the electoral registry.

Article 305: "The National Office for Electoral Processes may use the technology available and install any computer equipment it deems suitable in the Decentralized Offices for Electoral Processes in order to speed up and optimize the process of electoral computation."

Article 215: "The National Office for Electoral Processes is responsible for developing and executing simulation plans prior to the electoral process. Before each simulation, a manual tally of the test data shall be done to provide a comparison against the automated computation."

The use of technology is mentioned only in the process of electoral computation (the tally of results following the vote count at the polling stations). In this regard, Peru's election laws are designed to use traditional manual voting with paper ballots.

Article 206: "From the outset of the tally, the National Office for Electoral Processes places at the disposal of the legal and technical representatives the documentary information and computerized information from the vote tally sheets."

Here, reference is made to the use of computers for dissemination, although it does not indicate the form in which the results of the tally sheets, or *actas*, should be presented.

With respect to electronic voting, the only legislation (law approved by the Congress of the Republic or legislature) that exists under current election law is the First Complementary Provision of Law No. 28581, published on July 20, 2005. Under this provision, the Congress of the Republic authorizes the ONPE to:

> "progressively and gradually implement electronic voting via an electronic or computer medium or any other technological medium that guarantees the security and confidentiality of the vote, the identification of the voter, the integrity of the results, and the transparency of the electoral process."

Nevertheless, that authorization alone clearly would not allow electronic voting to be implemented, since the electoral legislation (basically the Organic Law on Elections, Law No. 26859) is written for manual voting, and not all the procedures outlined therein could be applied to electronic voting.

Accordingly, various alternatives have been considered to be able to fill the regulatory vacuum. One possibility was that the ONPE (as a constitutionally autonomous body) could approve a regulation for electronic voting. This possibility received a favorable opinion from the Committee on Constitution and Regulation of the Congress of the Republic, which interpreted the generic mandate in the First Complementary Provision of Law No. 28581—stating that the ONPE could progressively and gradually implement electronic voting—to include an implicit regulatory authority to approve the necessary regulations.

However, given that under Article 118, paragraph 8, of the Political Constitution, the power to issue regulations concerning laws rests with the presidency (that is, the executive branch), which exercises this authority through Supreme Decrees; and given that the Office of the President of the Council of Ministers has been promoting as state policy the "e-government" plan that includes electronic voting, it was considered fitting for the executive branch to be the one to approve the Regulation on Electronic Voting.

The ONPE drafted such a proposal and put it to the consideration of the Office of the President of the Council of Ministers. As of this writing, the referenced draft regulation—with some small modifications, basically formalities—has been approved at a technical level by that entity of the executive branch, and the only remaining step is for it to be approved through the respective Supreme Decree.

If approved, this regulation will not substitute the Organic Law on Elections, but will complement it in those constituencies in which the ONPE decides to implement electronic voting. The ONPE would also have the authority to issue any complementary provisions that turn out to be necessary for the application of the rules included in the regulation.

3.5.4 Citizen Accreditation and the Electoral Registry

As mentioned above, the entity responsible for accrediting and issuing the electoral registry is the National Registry for Identification and Civil Status, or RENIEC.

The RENIEC issues the National Identity Document (DNI) to all citizens in the country. Citizenship is acquired upon reaching the voting age of 18. The DNI constitutes the only identity card that entitles its owner to the right to vote.

The information that serves as a basis for issuing the DNI is recorded in an electronic database. It includes personal data, home address, locality, fingerprint, digitized photograph, and the citizen's scanned signature.

The main security features of the DNI include the following:

- Text that is sensitive to ultraviolet light and impossible to photocopy.
- Security thread with printed microtext that reads "Republic of Peru."

Figure 18: Front of the National Identity Document (DNI)
Source: RENIEC

- Watermark with the coat of arms of Peru, visible on both sides of the card (See Figure 18).

The technology used to produce the DNI includes a high-quality scan (digitization) of the citizen's signature, photo, and fingerprint. The DNI is printed with high-definition equipment and uses special paper for that purpose. The identity card is then cut, trimmed, die-cut, and laminated before it is ready to be given to the citizen (See Figure 19).

The data verification process uses an automated fingerprint identification system, which has also made it possible to eliminate multiple registrations by the same person and constitutes an essential element for guaranteeing the integrity of the database of citizens. The AFIS technology seeks to solve the so-called "NN" problem ("no-name" or unidentified citizens, as well as those who are deceased or incapacitated, or who do not have use of their mental faculties).

Before this system was in place, it was possible for the same person to register for illegal purposes in several places in the country. When the system was implemented, it detected more than 10,000 cases of individuals with more than one identity, and many other cases of individuals who tried to obtain an identity document using fraudulent documentation.
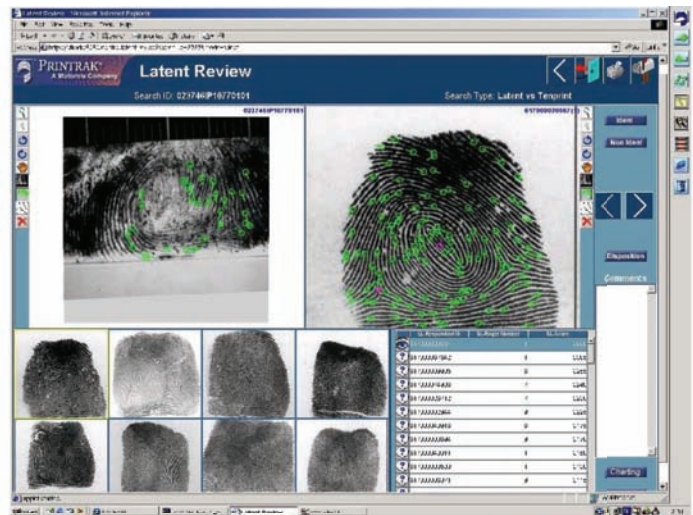

Figure 19: Automated fingerprint identification system (AFIS)
Source: RENIEC

The electoral registry includes a record of the following: name and surname, the person's unique identification code, a digitized photograph and signature, the names of the district, province, and department, and the number of the polling station.

By law, the registry is "closed" 120 days prior to the date of the elections in question. During that period, no changes can be made to addresses, names, or any other data

that would alter the information in the electoral registry. Additions to the civil registry made during that period are not included in the electoral registry that will be used for the election that has been convened.

After the electoral registry has been closed, the National Registry for Identification and Civil Status posts the voter lists in visible locations in the electoral districts participating in the process. These lists are generated from an electronic database that includes basic voter information. Using computer applications developed by the RENIEC, the lists are sorted by geographic location, then printed out and posted at each site so that citizens can make any observations they deem appropriate.

Once the electoral registry has received observations, the registry is presented to the National Office for Electoral Processes via an electronic medium (database) that includes the digitized signature and photograph of the voter (typically in JPEG files, a standard used for compressing photographic images). The electoral registry is audited by the National Electoral Board.

Voter data is provided in plain text files on digital video disks (DVDs). Due to the volume of information, the digitized photos and signatures are generated on data cartridges (magnetic tapes for data storage). In the national election held in November 2006, the electoral registry contained more than 16 million eligible voters.

Besides computer equipment and the local area network, the technology used includes mainly the following:

- Electronic database.
- High-definition scanners.
- Automated fingerprint identification system.
- Applications for capturing information and printing the voter registry.
- High-capacity, high-definition printers.
- DVDs and magnetic data tapes.
- Special security paper.

3.5.5 Candidate Registration and Election Oversight

The registration of candidates is the responsibility of the National Electoral Board. The JNE maintains an electronic database with information about the political organizations and candidates participating in an election. It uses an application it developed specifically for this purpose, the System for the Registration of Political Organizations (SROP).

This system was developed in 2002 with OAS support. The first time it was used was for the 2006 elections, during which the new law governing political parties also took effect. The SROP processes all registrations of political parties or movements and facilitates the registration of candidates. It also serves as a mechanism for verification and transparency of the electoral process. Thus it allows the JNE to administer candidate registration in a centralized manner. The process of registering political organizations has been certified with the ISO 9001 designation.

The system's database is updated daily so that both political parties and citizens can follow the process of party registration. The information in this database will later be used by political parties to register their candidates.

In addition, since under Peruvian law the registration of political organizations requires a certain number of signatures of adherents, and since votes on whether to keep officials in office require a predetermined number of signatures of local citizens, a process of signature verification is conducted; this is the responsibility of the RENIEC and the ONPE. The process involves comparing the data, signatures, and fingerprints of citizens recorded on the formatted physical lists of adherents with the information in the electronic database of citizens who are eligible to vote (maintained by the RENIEC).

The validation process is done by cross-checking the digital information with the semi-automated verification of signatures and fingerprints (a process that includes some human intervention), using a computer application developed specifically for that purpose. The process is supervised by a graphic-technical expert in order to provide technical credibility to the verification process.

The technology used in these types of processes includes the following:

- Electronic database.
- Systems for registration of political organizations and candidates, and data maintenance.
- Systems for the semi-automated verification of signatures and fingerprints.

As far as oversight of the election process is concerned, the National Electoral Board conducts the audit of the tally sheets or *actas*, a sheet-by-sheet review of whether the digitized information in the electronic database (processed by the ONPE) is the same as the information recorded on the tally sheets prepared by the poll workers. For this purpose, the process uses the digitized images of the scanned tally sheets and the electronic database containing the computation of results (provided by the ONPE).

In 2005, the National Electoral Board developed a computer application with Web technology, which has been installed on the institution's Intranet site. This automates the auditing process and allows the JNE to get a general idea of the computation for the declaration of results. The following graphic shows how the process of auditing the tally sheet works (See Figure 20).

In developing the application for the audit of the tally sheets, the National Electoral Board placed a priority on using free, open-source software. The application was developed by JNE personnel, and its use led to a savings of close to (U.S.) $800,000 when compared to the cost of a similar service contracted out for the 2002 electoral process.

The application has been utilized, with adjustments as needed, in all elections held in Peru since 2005.

In addition, to meet the goal of having information available in real time, the National Electoral Board developed the Information System for Electoral Processes (SIPE), which can be accessed nationally via the Internet. This makes it possible to have access to objective information in real time from any location in Peru that has access to the Internet.

The SIPE was developed to support the Oversight Procedures Manual, and each format that appears in the manual has its equivalent SIPE electronic version. In addition, the SIPE allows information to be consolidated for the preparation of reports for the highest body of the National Electoral Board and for decision-making at all levels. The SIPE has been used in all elections and popular consultations held in Peru since 2002 (See Figure 21).

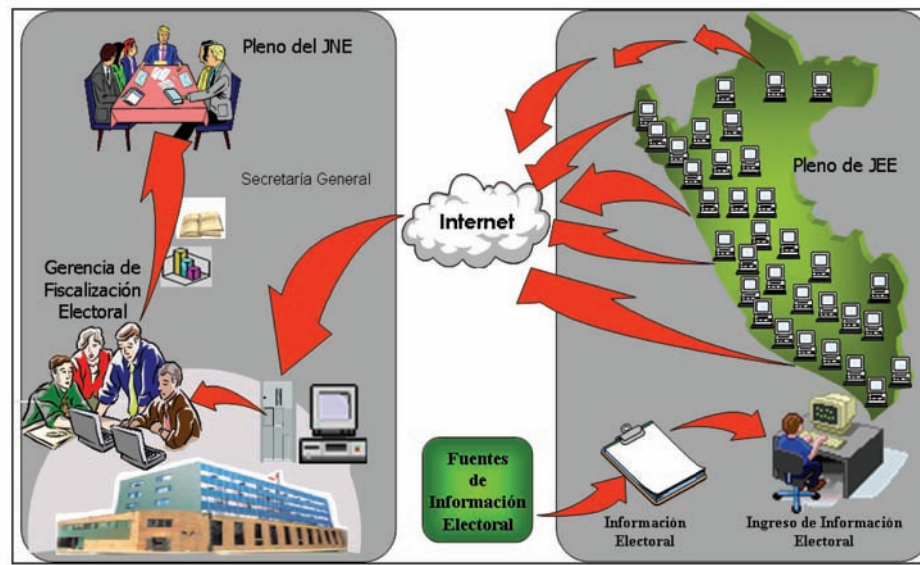Figure 20: Audit of election tally sheets
Source: JNE

Figure 21: Diagram of the electoral oversight process using the SIPE
Source: JNE

Finally, in 2006 the National Electoral Board developed an application using a Geographic Information System (GIS) that complements SIPE functions through visual monitoring of the election oversight effort at the national level. The application shows incident occurrences via GIS-controlled interactive maps.

The technology used includes:

- Electronic database.
- Internet.
- Computer application for auditing the tally sheets.
- Monitoring system for SIPE election oversight, complemented by a GIS system.

3.5.6 Electoral Organization

The preparation of voting materials is the responsibility of the National Office for Electoral Processes. At this stage, the technology used mainly has to do with the printing of the following documents: the voter ID cards, the tally sheets used at the polling stations, the instructional materials on voting procedures, and the list of voters by polling station, called the Acta Padrón. This process undergoes strict quality controls.

Since Peru still uses traditional voting (marked on a paper ballot), the process is mostly done by hand. This includes the logistical tasks involved in sorting election materials in accordance with the requirements established for each voting area.

The electoral materials include:

- List of voters by polling station (Acta Padrón).
- Ballots by polling station.
- Documentation sheets, or *actas*, for opening the polls, conducting the voting, and tallying the votes at the polling station.

The ONPE assigns voters to polling stations based on their home address, using a Geographic Information System to set up polling places in appropriate locations that will be easier for voters to reach and access physically.

After receiving the electoral registry and determining the location and composition of the polling stations, the ONPE holds a drawing to designate poll workers; these are citizens who will have the responsibility of conducting the election in each polling station. Citizens who are selected have the opportunity to present an excuse or justification for not fulfilling this duty; this information is recorded on a database for poll workers, via a client-server application developed by the ONPE—part of what is called the "Electoral Suite." In 2006, the ONPE set up close to 90,000 polling stations throughout the country.

The technology involved in this process includes mainly the following:

- High-capacity printers.
- Special security paper to prevent election materials from being falsified or altered.
- Electronic database.
- Computer application for recording and maintaining information concerning poll workers.

For the distribution of voting materials, the ONPE uses a computer application designed to control the flow of election materials. The sorted and classified materials are transported to regional distribution centers, with the support of the Peruvian armed forces, via air, sea, and land, depending on the geographical area.

3.5.7   Consolidation of Results

The consolidation of results is a highly technical process, due to the fact that the electoral body has focused its efforts on introducing technology to the computation and presentation of results.

In terms of the infrastructure, the ONPE sets up decentralized computing centers for each electoral process, as well as a main computing center where all the information is consolidated on a national level.

Each decentralized computing site has a local area network, with computer equipment used to digitize the information contained in the tally sheets and consolidate results for the corresponding electoral district. The ONPE's client-server computer application for this purpose, the Electoral Suite, controls data entry and adds local results to an electronic database.

The client-server architecture basically means that one program (the client) makes requests of another program (the server) that provides answers. The server program is the one that establishes contact with the electronic database (See Figure 22).

As can be seen in the above diagram, the tally sheets are grouped into batches and then submitted to a dual digitization process (digitization and verification) done by different staffers to minimize the risk of fraud and error in the entry of data. Each computing center has an area for observers, from which accredited personnel can watch the process of digitizing the results.
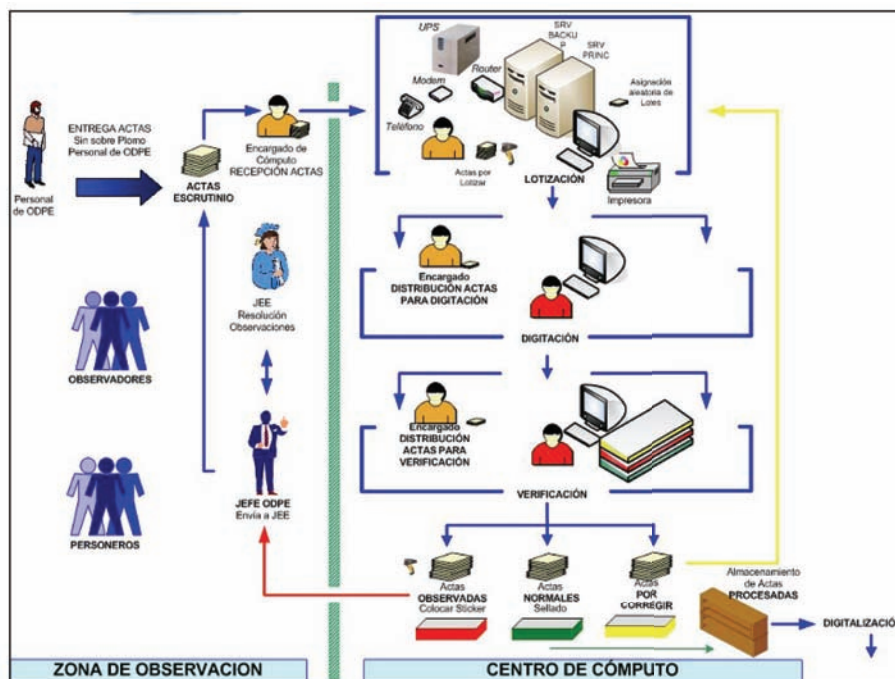

Figure 22: Digitization of results at the computing center
Source: ONPE

The information is then sent to the main computing center via a communication line, typically a VPN (virtual private network), over a digital data line. The ONPE contracts for dedicated lines through a public bidding process. The data is transmitted in a symmetrically encrypted form, using the 3DES algorithm with a 162-bit longitude code (a highly secure and reliable algorithm). It is estimated that for a national election, the installation of the VPN costs approximately (U.S.) $1,350,000.

After the information has been digitized and the data transmitted to the main computing centers, the next step is the scanning of the tally sheets. Files of the digitized images are created and posted on the ONPE Web page, where they can be consulted by the public.

The decentralized computing centers have contingency measures such as backup power (electric generator), uninterrupted power supplies, backup computer equipment and servers, ISDN communication lines (integrated services digital network, which uses the public telephone system infrastructure), fire extinguishers, and other security measures that seek to guarantee integrity,

continuity, and efficiency in the process of data capture (See Figure 23).

In cases in which it is not possible to establish virtual private networks over the dedicated lines that have been contracted, satellite linkups are used.

The computing center for the consolidation of data and results has a main server, a backup server, and a Web server for publishing results. Once the information is received in the main computing center, it is stored in an electronic database. The Electoral Suite software also has the capacity to consolidate results at the provincial, regional, or national level, or in any way that may be required for the electoral process.

The main computing center is the one with the most equipment and greatest capacity, with special security measures such as firewalls, a demilitarized zone, deep security, and an intrusion prevention system, among other things, in order to protect the network from unauthorized access.
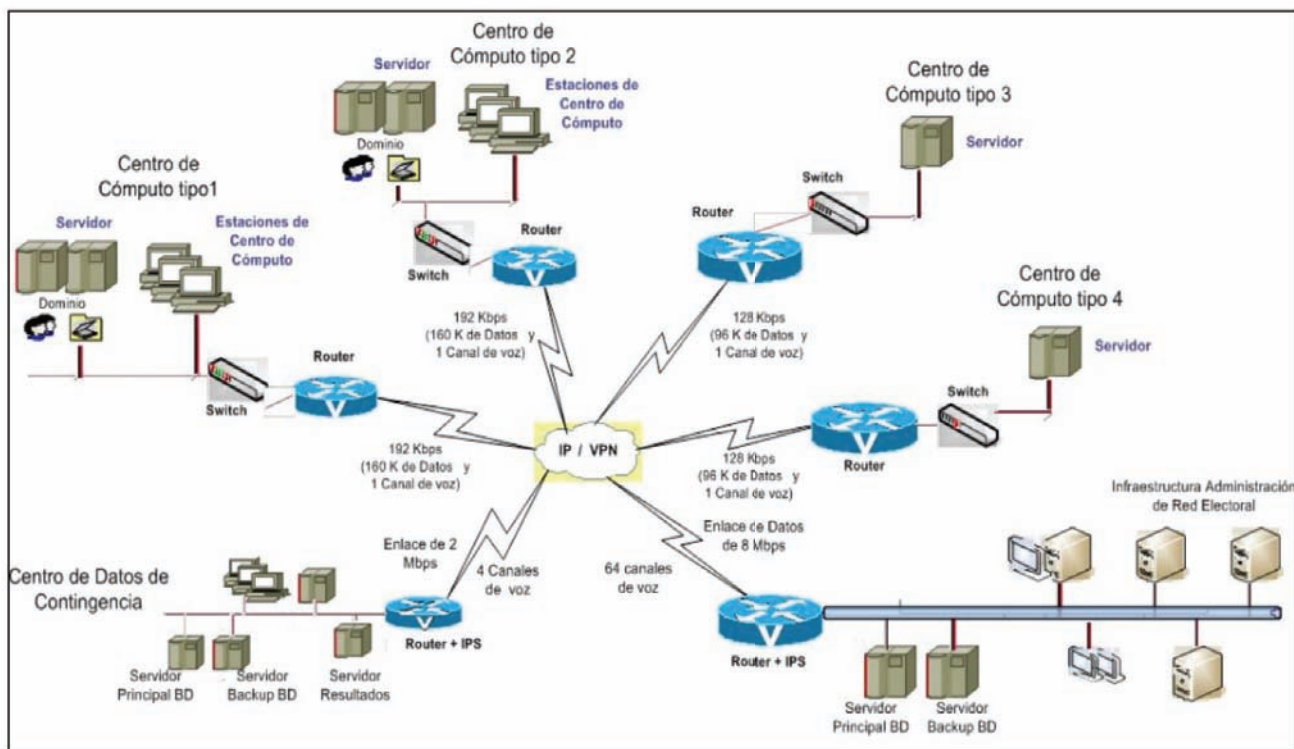

Figure 23: Diagram of the computing centers
Source: ONPE

In summary, the technology used in the computation of results includes:

- Electronic database.
- Electoral Suite software for the digitization of results.
- Local area network.
- Wide area network.
- Transmission of results (VPN and ISDN).
- Backup equipment (electric generators, UPS).
- Means of transmission (dedicated lines, satellite linkup, public telephone network).
- Internet.

Once the results have been properly consolidated in the electronic database, the ONPE presents progress reports on partial results and final results of the process, using its Electoral Suite software for this purpose. The results are presented at news conferences with the participation of both national and international written press and radio and television media.

Election results are also posted on the electoral body's Web page, where they can be consulted by the public. The digitized images of the tally sheets can also be viewed on the Web. Information is updated on a continuous basis as data from the tally sheets is processed.

The technology used includes:

- Electronic database.
- Electoral Suite program to generate reports and allow consultation of results.
- Internet.

In conclusion, Electoral Suite is the most important computer application under the current system for conducting an electoral process in Peru, as it consolidates the results of the election. This software has been used since 2001. It completely replaced the previous application, called the National System of Elections, which had lost credibility as a result of the accusations of fraud that arose from the 2000 presidential election.

Electoral Suite began to be used in the 2002 regional and municipal elections. Its initial development was contracted out to third parties, with the contract being awarded to a consortium made up of two of the

country's leading technological firms. Since 2003, all the improvements and modifications to the software have been developed directly by the ONPE.

3.5.8 Electronic Voting

Peruvian law already allows for electronic voting to be used in any of its forms. The ONPE has made progress in this area and expects to implement electronic voting in order to minimize voting errors, facilitate the electoral process, speed up the computation of results, and reduce the costs of electoral organization, training, and logistics.

The first electronic voting was done in Peru in 1996, specifically in two places. The first was in the Huancavelica District, in the province and department of the same name, and the second in the District of Santiago de Tuna, in the province of Huarochirí, Department of Lima (both in extremely poor areas of the sierra). The main problem that arose was not that the machines were hard to use, but that they didn't always work, since the necessary testing had not been done beforehand.

Seventy electronic voting machines were purchased for this pilot program. In the district of Huancavelica, 57 machines were distributed between two voting sites with 22 and 35 polling stations, respectively. In the District of Santiago de Tuna, two of the electronic voting machines used were similar to those that had been used in Brazil's municipal elections that same year.

In 2002, a demonstration project for in-person electronic voting was implemented for the November 17th regional and municipal elections. This used touch-screen stations that displayed the voter identity document, along with an administrative server used by the president of the polling station to verify the identity of the voter and assign him or her to one of the voting booths.

During the implementation of this test, it was found that the system was easy to understand and that the time spent to cast a vote was less than with the manual voting system in use. This factor would allow for an increase in the number of voters per polling station.

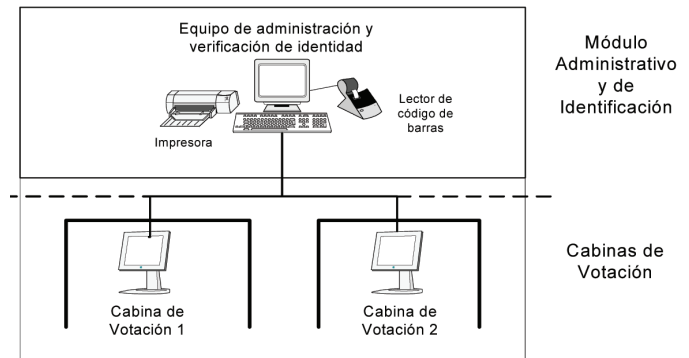Figure 24: Secret voting booth for electronic voting
Source: ONPE

Figure 25: Electronic voting network
Source: ONPE

For purposes of the test, each of the networks or systems consisted of (a) a computer called the administrator machine, which was set up to assist and accredit the voter; (b) a small printer; (c) a barcode reader; and (d) the voting booths with their respective touch screens. Each system could handle a maximum of six screens at once.

Before deciding to use touch screens, the ONPE technicians did some testing with voters to learn how easy and user-friendly it would be for people to vote with three different options:

1) Using a normal computer and voting with a keyboard.

2) Using a normal computer and voting with a mouse.

3) Voting with the touch screen.

The tests showed a clear preference for the touch screens (See Figure 24).

The procedure to participate in the electronic voting test was designed to be simple and fast. A barcode reader captured the voter's ID number to certify the person's identity, and printed out a ticket indicating the booth in which he or she was to vote. The voter immediately went to the booth and proceeded to vote by touching the symbol on the screen corresponding to the political party of choice. The voter would then return to the polling station to pick up his or her identity document, concluding the person's participation in the electronic voting test.

Each voting booth could handle approximately 300 voters, and each team for administration and identity verification (polling station) could have up to 4 booths, which would mean an average of 1,200 voters per polling station.

In cities without electric power, generators (or batteries) were taken to power the computers. In these places, the results were recorded on a diskette or CD and taken to the closest transmission center.

The transmission of results was done through an IPVPN linkup (Internet Protocol Virtual Private Network), through which the consolidation servers were authenticated by the main server in order to send the information. The medium used to take the voting information to the consolidation servers were diskettes, CDs, or a physical or wireless transmission method if the voting areas were close to the consolidation site.

The system allowed for options to be presented on a touch screen that displayed lists and candidates. The voting process occurred as follows:

a. The voter presents his or her identity document to the polling station president, who reads the number on the document with a barcode reader to verify the voter's identity.

b. The voter's data then appears on the screen of the computer operated by the polling station president, and the system displays a caption indicating the voting booth assigned to that voter.

The president of the polling station can handle several voting booths at the same time.

c. Once a voting booth has been assigned, the voter proceeds to the assigned booth to cast his or her vote, making selections on the touch screen. Once the voter has made all of his or her selections among the electoral options, the process is finished and the voter may leave.

The system tested eliminates the use of traditional election ballots and does not include a printout of a tangible voting receipt (See Figure 25).

The biggest cost estimated by the ONPE for implementing the system is voter training, and the second involves ensuring that the country's telecommunications infrastructure can support the needs for interconnection and information transmission. These issues are quite apart from any legal modifications that may be required. The plan that has been designed intends to bring electronic voting to the public gradually, which presupposes specific training and information programs for each election. To this end, pilot tests are being conducted continually for civil society elections and political party primaries.

In 2005, the ONPE asked international companies for demonstrations of electronic voting approaches, but the ONPE's final decision appears to be to gradually develop its own electronic voting system. That would allow it to have control over the devices and equipment used in voting.

However, as of the date of this study, the in-person electronic voting system has not been used officially, only in tests. It is expected that electronic voting will be introduced, gradually, beginning in 2011.

3.5.9 Challenges

The gradual introduction of electronic voting, projected to begin in 2011, is one of the major challenges for the Peruvian electoral system. It is also expected that by 2011, distance voting over the Internet can be implemented for citizens who cast their votes abroad. That will be possible only after fine-tuning the appropriate legal procedures, as these are still not ready to handle the various schemes for electronic voting.

One of the next steps for the RENIEC will be to create an electronic voter identification document, made of polycarbonate, printed with a laser, and containing a chip with information of the document's owner, including his or her fingerprints. Preliminary studies are currently underway, thanks to financial support from the Spanish Government in the amount of 100,000 euros. The electronic voter ID would look much like a credit card, with a series of security elements recorded on a laser that would make the card impossible to falsify or would facilitate the detection of adulterated documents.

The new identity document will use an electronic chip that makes it possible to store the certificate activating a digital signature on electronic documents; thus, it is considered to be the key for developing e-government in Peru. This could become a reality by 2011. The new document will make it possible to corroborate the holder's identity for electronic transactions, electronic voting, and digital signatures and certifications used in electronic documents and procedures. It also has the potential to store medical files, bank account information, and other data.

4   Electoral Technologies in the Americas: Final Comments

Without a doubt, the countries of Latin America are gradually making progress in the implementation of technology in the electoral process. As the information gathered in this study indicates, the use of technical mechanisms—whether systems for the transmission of preliminary results, the dissemination of election information on Web sites, or electronic voting—is becoming more and more common. This reflects an important evolution in the organization and administration of elections.

The degrees of implementation vary widely. For example, this document shows that there is no international standard among the countries for the use of technology in the electoral process. In Chile, the technological modernization of the electoral process is not necessarily considered a priority, and the use of technology is limited, mostly confined to a national communications network (Intranet) and an efficient system for transmitting preliminary results. In other countries, such as Peru, Costa Rica, and Jamaica, significant efforts are underway to create electronic voter registries that use biometric identification features. Pilot plans are also being carried out to use electronic voting, taking full advantage of technology. One country that has made a major effort to modernize its electoral process at different stages is Mexico. This study showed the usefulness, in the 2009 Local and Federal Elections, of a project that teamed up with Google to inform voters, through electronic maps, about where they should go to cast their ballots. However, unlike Peru or Costa Rica, Mexico's short- and medium-term plans do not include implementation of electronic voting in federal elections.

Successful experiences in the region have been registered regarding the incorporation of electoral technology. However, there still persist important challenges to consider. In the first place, it is vital to identify specific mechanisms that the electoral body has to provide access to the political party officials regarding the process of electoral technology applications. Moreover, the main challenge is to strengthen the capacities of these officials to be aware of what elements need attention. Tied to this, and in the interest to strengthen transparency in the application of these technologies, it is vital to educate the voter about the technological elements utilized to exercise their political rights. In this manner, questioning over the use of technology is avoided and major acceptance over the process and the results by the electorate is guaranteed. One last challenge has to do with the costs associated with the application of these technologies, especially in countries with scarce economic capacity. It is vital that society defines if the benefits of applying electoral technologies outweigh the costs of its acquisition[19].

It is critical to have a consensus on implementing these types of technologies. The case studies show that in most of these countries, the application of electoral technology continues to be an issue for debate and analysis, and this will continue to be the case as long as new tools keep emerging. The Organization of American States looks forward to being able to continue promoting the discussion of these issues.

---

[19]   The 2005-2006 Electoral Cycle in the Americas: A Review by the OAS General Secretariat, p. 53. Washington, DC.