STUDY VISIT TO BRAZIL ON ELECTRONIC VOTING MACHINES

15 - 16 April, 2024

Prepared By

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I N D E X

ABBREVIATIONS

ECP	Election Commission of Pakistan
CEC	Chief Election Commissioner
EVM	Electronic Voting Machine
DRE	Direct Recording Electronic
PCOS	Precinct Count Optical Scanning
VVPAT	Voters Verified Paper Audit Trail
BVM	Biometric Verification Machine
E-Voting	Electronic Voting
COMELEC	Commission on Election (Philippines)
DDoS	Distributed Denial of Service
CSO	Civil Society Organization
IBM	International Business Machine
HP	Hewlett - Packard
CU	Control Unit
BU	Ballot Unit
VB	Voting Booth
ATM	Automatic Teller Machine
PST	Public Security Test (Brazil)
PTA	Pakistan Telecommunication Authority
TSE	Tribunal Superior Electoral
TRE	Tribunal Regional Electoral
Nedap	A Dutch Multinational Technology Company
ICT	Information Communication Technology

INTRODUCTION
(PURPOSE OF VISIT TO BRAZIL)

Election Commission of Pakistan (ECP) is continuously implementing significant measures to improve the electoral process of Pakistan and is keen to induct latest technologies in electioneering processes. ECP is considering conduct of pilot tests of Electronic Voting Machines in the electoral process of Pakistan as per Section 103 of the Elections Act, 2017.

Brazil is one of the leading countries in the world that has introduced advanced Electronic Voting Machines (EVMs) since 1996 for municipal elections and later in 2002 for presidential elections nationwide, having vast experience in this regard. ECP aims to draw upon Brazil's extensive experience in using these technologies in the electoral process. For detailed research and analysis, a high level delegation of ECP headed by the Hon'ble Chief Election Commissioner of Pakistan, accompanied by Provincial Election Commissioner Punjab, Director General (IT - Policy & Planning), and Director (ECP), visited Brazil during mid-April 2024 to observe the implementation of EVM in their electoral system through an evolutionary process over a period of two decades. The purpose of the visit was not only limited to technology but also to meticulously evaluate and assess the whole digital ECO system of the electoral life-cycle integrated with their legal framework, which also included discussion on the issues associated with EVM and way forward for the successful implementation of EVMs in the country.

Another prime objective of the visit was to engage in bilateral discussions between the Hon'ble Chief Election Commissioner of Pakistan and the President, Tribunal Superior Electoral (TSE) on various topics, including the use of EVM and its challenges revolving around legal, electoral and technological frameworks.

PROGRAMME

15th April, 2024 (Monday)

14h00-15h00:

Visit to the Museum of the Vote and contact with the evolution of the Brazilian voting machine

15h00-16h30:

Advisory for Identification Management (AGI)

Meeting with Mrs. Marília Loyola Barreiro Rocha, Head of AGI

"Identification systems in use, including biometry"

16h30-18h00:

Secretary of Communication and Multimedia (SECOM) and Special Advisory for Fighting Disinformation (AEED)

Meeting with;

(i) **Ms. Giselly Siqueira,** Secretary Communication & Multimedia (SECOM);

(ii) **Mr. José Chuy,** Head of AEED, Special Advisory for Fighting Disinformation (AEED);

"Initiatives for strengthening social confidence on the Electoral Justice"

16th April, 2024 (Tuesday)

15h00-18h00: Information Technology

Meeting with **Mr. Julio Valente**, Secretary for Information Technology

"Introduction to the Brazilian Electronic Voting Systems"

Demonstration of the Brazilian Electronic Voting Machine

18h00-18h30:

Meeting of **Mr. Sikandar Sultan Raja,** Hon'ble Chief Election Commissioner of Pakistan with **Mr. Justice Alexandre de Moraes,** President, Tribunal Superior Electoral (TSE).

BILATERAL TALKS

Hon'ble Chief Election Commissioner of Pakistan and President Tribunal Superior Electoral, Brazil

Mr. Justice Alexandre de Moraes, President Tribunal Superior Electoral (TSE) cordially welcomed Mr. Sikandar Sultan Raja, Hon'ble Chief Election Commissioner of Pakistan and accompanied the delegation in his office. He briefed about paradigm shift from paper ballot to electronic voting in order to prevent all types of paper ballot frauds by giving major cogent reasons. For instance, he informed that there was a big scandal, which took place in early 80s in the state of Rio de Janeiro, Brazil. It involved spoiling of ballot papers, submission of blank ballot papers (by illiterate voters), tampering of result sheets, frauds in counting of ballot papers by election officials. These officials converted genuine ballot papers into defaced ones with malicious intent, rendering them invalid or rejected. Thereafter, TSE decided to introduce electronic voting in an evolutionary manner in the country by introducing EVMs in year 1996 in the Municipality Elections. The Brazilian nation takes pride in this revolutionary act by introducing digital voting and preventing all kinds of manual and paper ballot frauds in compilation of results.

The Hon'ble Chief Election Commissioner of Pakistan offered his gratitude to President TSE for receiving Pakistani delegation in Brazil. He appreciated the extended hospitality and recognized their efforts to introduce electronic voting as a significant step towards modernizing the electoral process in Brazil. He also briefed the President TSE about Pakistan's legal and electoral frameworks, providing detailed information along with vital statistics in this regard. This kind of communication is essential for promoting transparency and ensuring that both parties are well informed about electoral processes, experiences and regulations in both the countries. He further informed that majority of decisions made by the ECP were upheld by the Supreme Court of Pakistan including high-profile cases.

	*Mr. Sikandar Sultan Raja, Hon'ble Chief Election Commissioner of Pakistan presenting shield to Mr. Justice Alexandre de Moraes, President, Tribunal Superior Electoral (TSE)*
Mr. Sikandar Sultan Raja, Hon'ble Chief Election Commissioner of Pakistan receiving souvenir from Mr. Justice Alexandre de Moraes, President Tribunal Superior Electoral (TSE)	
	*Joint photo session of Mr. Sikandar Sultan Raja, Hon'ble Chief Election Commissioner of Pakistan and Mr. Justice Alexandre de Moraes, President Tribunal Superior Electoral (TSE)*
In audience: Mr. Sikandar Sultan Raja, Hon'ble Chief Election Commissioner of Pakistan and Mr. Justice Alexandre de Moraes, President Tribunal Superior Electoral (TSE), sharing experiences between the two Constitutional Heads of Pakistan and Brazil.	

HIGHLIGHTS OF THE MEETINGS

BRIEFING BY

HEAD OF ADVISORY FOR IDENTIFICATION MANAGEMENT

Ms. Marília Loyola Barreiro Rocha, Head of Advisory for Identification Management (AGI) gave briefing on “Advisory for Identification Management”, the salient features are given below:-

Since 2000 Municipal Elections, the entire Brazilian population chooses, through the electronic ballot box as to who will represent them. Although the technology was successfully adopted for voting, at that time. In this procedure, polling officials handle documents from voters, verify the information, and manually input registration numbers into an electronic system to enable voting. While this method may ensure accuracy to some extent, its labor-intensive and could potentially be improved with more automated or digitized solutions. Such advancements could streamline the process while maintaining the integrity of the electoral system.

To make the electoral process even safer and prevent a person from voting for another, the Electoral Court started the project for biometric identification of the electorate. The adoption of biometrics technology has significantly reduced impersonation or intimidation in the voting process. The digital ballot is only available for voting, when the biometric reader identifies the voter's fingerprints, which are electronically verified using the unified database of the Electoral Court.

In 2008 Elections, biometrics was tested for the first time in the municipalities of São João Batista (Santa Caterina), Fátima do Sul (Mato Grosso do Sul), and Colorado do Oeste (Rondônia). After the success of the biometric review in the three cities, the Electoral Court decided to continue (in 2010) project in another 57 municipalities. Thus, in that year's general elections, 1.1 million voters from 60 municipalities of 23 states voted using biometric verification technology.

In 2014 elections, around 21 million citizens from 764 municipalities in all states and the Federal District were able to use biometric identification. Similarly, the number of

people biometrically registered exceeded 85 million in 2018 elections. Now, in 2024, approximately 128 million Brazilians had completed the biometric registration.

In response to COVID-19 pandemic, the 2020 elections adapted to ensure safety. By following the Health Security Plan developed by the TSE in collaboration with the Ministry of Health (Fiocruz), Albert Einstein, and Sírio-Libanês hospitals, biometric identification of voters was suspended. For the same reason, electoral offices across the country suspended the registration of new biometrics until the current health emergency is regularized.

In any case, it is expected that almost 100% of the electorate will be able to vote with biometric identification by the 2026 elections.

BRIEFING BY
SECRETARY COMMUNICATION AND MULTIMEDIA

Ms. Giselly Siqueira, Communication & Multimedia Secretary of Tribunal Superior Electoral gave detail briefings on “Brazil Tribunal Superior Electoral’s Experience in Combating Disinformation”, the TSE had taken following steps to counter disinformation, fake news and misinformation challenges and its salient features are as under:-

i) All types of disinformation, misinformation or fake news regarding the electoral body or any election process was immediately responded using same digital medium;

ii) Main focus on addressing youth voters;

iii) Optimum use of all major social media platforms such as Facebook, Instagram, X former Twitter, WhatsApp, etc;

iv) Hired the services of key Brazilian soccer players to attract public at large, to further dispel the impact of fake news and nullify it in real-time mode;

v) Promoted technology to gain public trust and confidence of public;

vi) October to December 2020, about 75 major clarifications were issued;

vii) August to December 2022, about 155 clarifications were disseminated;

viii) High-end monitoring system were introduced using various platforms;

ix) Partnership with Google, Facebook (Meta), WhatsApp and all Cell Phone companies using Android and Artificial Intelligence (AI) for search and sending notifications along with institutional messages from TSE instantly;

x) Partnership with iPhone using **e-Titulo** App (specialized mobile App) to combat disinformation attacks on TSE;

xi) Persuaded voters at large to vote, as it is compulsory voting in Brazil.

She elaborated that adopting a multi-stakeholder and systemic approach to disinformation turned the disinformation mitigation program, implemented during the 2020 and 2022 Elections, into the most expansive and innovative project ever undertaken by an electoral body to counter fake news. The followings are the ten innovative initiatives of the program:-

1. *Establishment of the Verification Coalition* – 2020 – 2022 Elections: network formed by nine verification institutions to check fake news related to the Electoral Process;

2. *Establishment of the Fact or Rumor page*, on the Electoral Justice website, to centralize the verification of false information published during the elections, allowing access by all citizens to the contents of the page without charging for data traffic (zero rating) by mobile phone operators;

3. *Development of a Chatbot on WhatsApp*, which allowed voters to access verified news and clear up doubts about the Electoral Process, with almost 20 million messages exchanged;

4. *Establishment of a notification center in the Electoral Justice applications e-Titulo, Mesários and Pardal,* allowing direct communication between the Electoral Justice and the more than 18 million users of these applications;

5. *Formalization of partnerships with some of the main Internet application providers,* through the signing of agreements that provided for specific measures to combat disinformation and ensure a healthier informational environment during elections;

6. *Establishment of a network of quality content broadcasters on the Electoral Process on social media,* with the launch of the #EuVotoSemFake (I Vote

Without Fake [News]) campaign, which had the participation of media associations, public and private entities, and any citizens who wished to participate; and the #NãoTransmitaFakeNews (Don't Share Fake News) and #PartiuVotar (Go Vote) campaigns, with the participation of the Brazilian Football Confederation (CBF) and several national football clubs;

7. *Launch of the media campaign If It's Fake News, Don't Share It*, to educate voters about the phenomenon of disinformation and the dangers of disseminating fake news, broadcast on TV, radio and social media;

8. *Establishment of an extrajudicial channel to report bulk messaging, in partnership with WhatsApp,* which allowed analysis of behavior by the platform and the banning of accounts that carried out bulk messaging during the elections;

9. *Establishment of a monitoring network of disinformation practices harmful to the Electoral Process,* which, with monitoring tools from social media and strategic partners, managed to identify cases and practices of disinformation against the Electoral Process and act, together with social media, to tackle structured networks of disinformation dissemination and inhibit inauthentic behavior and misleading content;

10. *Establishment of the cyber-intelligence committee* to facilitate rapid action and communication in the event of cybersecurity incidents during the elections.

The Electoral Justice Permanent Program on Countering Disinformation, established by Ordinance-TSE nº 510, of 4th August, 2021, represents the continuity and improvement of the efforts of the Superior Electoral Court (TSE) to reduce the harmful effects of disinformation regarding Electoral Court and its members, the electronic voting system, the electoral process in its different phases and the participants involved. Thus, disinformation content directed at pre-candidates, candidates, political parties, coalitions, and federations is exempt from its scope, except in cases where the conveyed information could harm the integrity, credibility, and legitimacy of the electoral process.

The creation of the program is aligned with the constitutional mission of the TSE to ensure that the electoral process takes place legitimately and democratically, falling within the Court's administrative competence, without any sanctioning bias. The approach adopted, consisting of the main norms, research, and recommendations on disinformation at the national and international level, is systemic, multidisciplinary, and multi-sectoral. Concerning these parameters, a "network" model of organization and operation was chosen, based on the involvement of the Electoral Justice bodies and the formation of strategic partnerships with multiple participants. In this scenario, the TSE acts as a hub for dialog, cooperation and engagement of the whole society.

To facilitate integration and coordination among the strategic units of the TSE, the Program is internally organized with a Management Group, a Strategic Committee for Confronting Disinformation, and an Analysis and Monitoring Group. Starting from Justice Luiz Edson Fachin's mandate onwards, these units will operate under the oversight of the Special Advisory for Confronting Disinformation (AEED), responsible for executing the actions outlined in this Program.

A national strategy was also planned that integrates the other Tribunal Regional Electoral (TRE) in efforts to acting against disinformation. Finally, the Program organizes relationships with partner entities, such as: (i) media vehicles; checking organizations and other associations representing sectors of the press; (ii) internet service providers, including social networks, private messaging services and search engines; (iii) political parties; (iv) public entities or bodies; (v) technology companies; (vi) associations, foundations, institutes, research institutions, movements or groups, including those from public and private universities, with expertise in issues of disinformation, freedom of expression, technology, democracy, elections, electoral law and human rights, and notable public recognition in its area of expertise.

The permanent character of the Program guarantees not only its own structure with exclusive dedication, but also: the continuous training of the team; the construction of knowledge and innovation management processes; uninterrupted dialog with partners; the strengthening of network operations and the development and execution of medium and long-term strategies against disinformation. The actions to be developed are distributed in three axes: (i) Inform, aimed at the dissemination of official, reliable and quality information; (ii) Empower, aimed at media literacy and

training the whole of society to understand the phenomenon of disinformation and the functioning of the electoral process; and (iii) Respond, related to the identification of cases of disinformation and the adoption of strategies, both preventive and repressive, to contain its negative effects.

For 2022 electoral cycle, the first axis has five projects with their own purposes and goals. They are: (i) mass dissemination network of truthful and official information about elections and the Electoral Justice; (ii) chatbot – electoral queries on WhatsApp; (iii) access, dissemination and enhancement of the scope of fact checking on the electoral process; (iv) deepening electoral transparency; (v) development and improvement of other technological tools and digital channels to disseminate true and quality information. In this strategic point, the Court's action is guided by the preferential position of freedom of expression, in the legal system, by encouraging plurality of information. Likewise, information actions meet the recommendations for "prophylactic" pre-bunking actions (that is, strategies to reduce citizens' susceptibility to disinformation by exposing examples of how disinformation operates).

The second axis, in turn, includes seven initiatives: (i) training for internal and external audiences on disinformation, on the integrity of Brazilian elections and on the fundamentality of the Electoral Justice as an institution that guarantees democracy; (ii) prevention of the mental health of members, agents and collaborators of the Electoral Justice who deal directly with actions to contain disinformation; (iii) training the internal and external public on the electoral process, including the functions performed by it in the context of the democratic rule of Law; (iv) awareness campaigns on disinformation and media and information education actions for the external public; (v) cooperation and actions to enhance reaching partners' media and information literacy initiatives; (vi) dialog with political par ties and party federations to make them aware of their responsibility in the context of fighting against disinformation; (vii) support to other public institutions to implement actions to confronting disinformation.

Finally, the response axis encompasses eight projects: (i) permanent coalition for verification; (ii) engagement of digital platforms and their technological resources in confronting structured networks of disinformation and inauthentic behavior; (iii)

reporting channel for mass shooting of content in partnership with WhatsApp; (iv) creating a network to monitor disinformation practices against the electoral process; (v) containment of disinformation on Telegram; (vi) partnership and dialog with the Federal Police and the Electoral Prosecutor Office; (vii) Strategic Cyber-intelligence Committee and (viii) review and elaboration of norms that acts against the practice of disinformation in the Electoral Justice, as a way of preventing the phenomenon in question. Concerning to this point, the planning met the parameters of timely response, appreciation of fact checking, importance of engagement and transparency of platforms, as well as the expansion and improvement of channels for complaints. This strategic plan defines regulatory frameworks, theoretical references, scope, axes, institutional organization, and multi-sectoral actions and strategies developed for the 2022 electoral cycle.

BRIEFING BY
SECRETARY FOR INFORMATION TECHNOLOGY

Mr. Julio Valente, Secretary for Information Technology gave detailed presentation on “The Brazilian Electronic Voting System”, salient features of which are reproduced here under:-

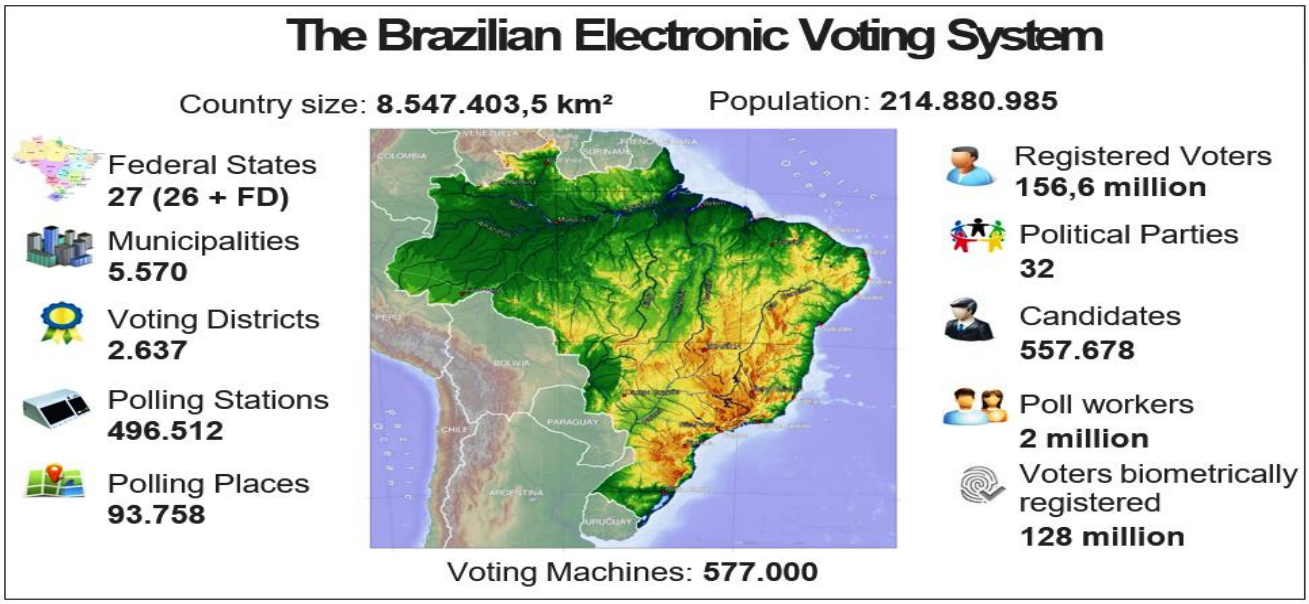
Agenda

1. Overview of the Brazilian electronic voting system
2. Reasons for the introduction of Information Communication Technology (ICT) in elections
3. Principles of ICT introduction
4. Successful ICT strategies
5. Evaluation of ICT usage
6. New times, new challenges

The Brazilian Electronic Voting System

- The Brazilian electronic voting process encompasses regulations, procedures, systems, and machines.

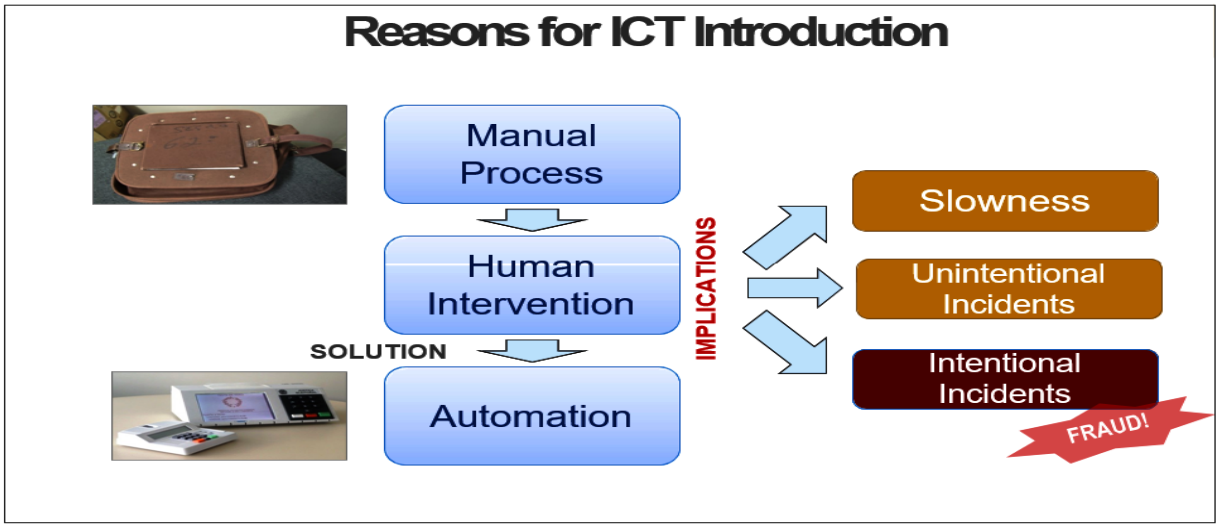
- The model allows for voting, tallying, and disclosure of results in few hours.
- The pioneer process developed and used in Brazil has successfully overcome frauds in paper ballots.
- The security and the accuracy in the tallying process received the high integrity seal in the last Electoral Integrity Global Report (92 in a scale 0-100)



Reasons for ICT Introduction

Motivation for implementing the electronic voting:

1. Attempt to defraud the Rio de Janeiro State Governor election, in 1982 (an incident known in Brazil as “the Proconsult scandal”).
2. Several broadly known methods to defraud ballot papers and change the tally lists of precincts out of reach of party inspectors.
3. Numerous requests for ballot recounts and cancellation of elections, causing delays in the publication of the results and social instability.



- Before the advent of electronic voting, the will of the voter was not respected.

- Fraud occurred especially in procedures with human intervention, such as manual counting of ballots.
- The Brazilian Electoral Justice did not import a ready-made solution. Instead, it was developed, its own indigenous product within Brazil.

Principles that guided the design of the Brazilian electronic voting machine:

1. Standardization
2. Compliance with Brazilian laws
3. User-friendly process
4. Reduced cost
5. Durability
6. Safety
7. Simpler logistics
8. Autonomy

Successful ICT Strategies

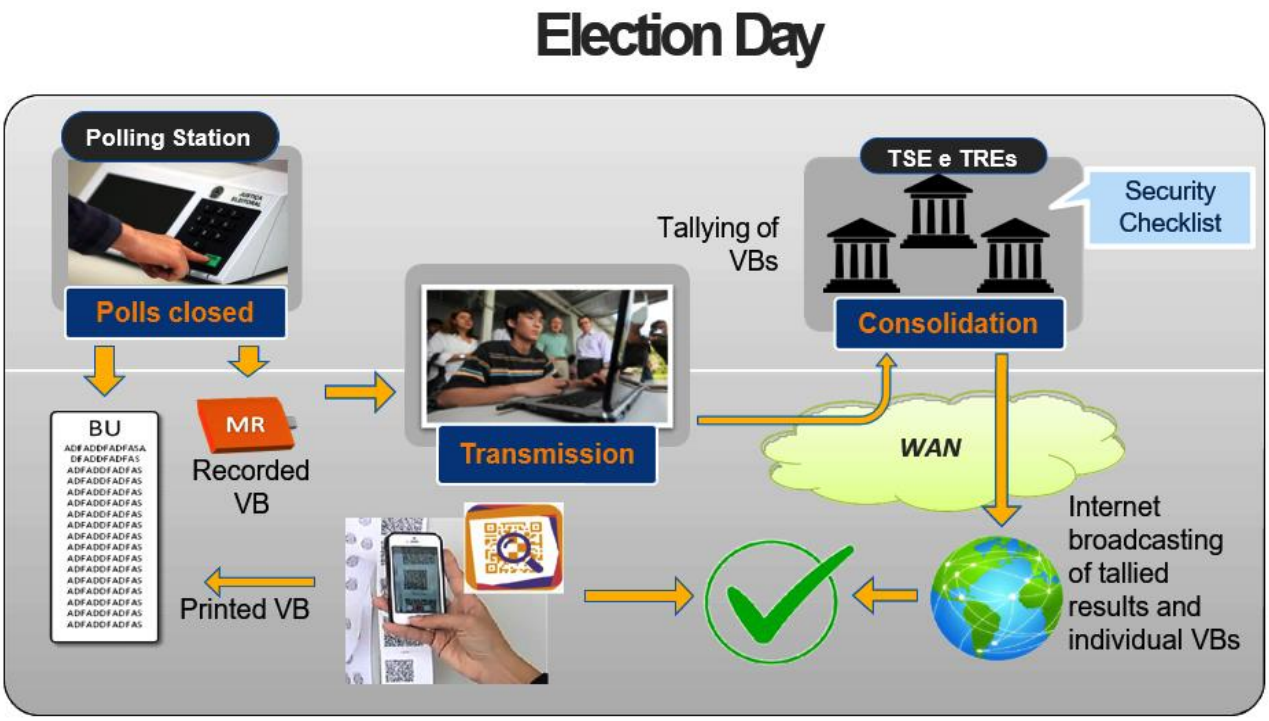
- The Brazilian electronic voting system has as its main element the use of electronic voting machines. Some key characteristics of electronic voting machines are:
    - ✓ The equipment is offline and the software that runs across the country is the same. The development of this software is monitored and electronically signed by the political parties, the Brazilian Bar Association and the Public Prosecutor's Office.
    - ✓ The voting machines are replaceable in the event of a problem in the equipment during the voting.
    - ✓ The interaction of the user with the voting machine takes place through a numeric keypad (similar to the telephone ones). This allows the participation of voters with different levels of education, including illiterate and native people.
- The electronic voting machine is equipped with an audio output, which allows the voter to connect headphones and thereby allows the visually impaired to

vote, along with the Braille writing that is also a component of the voting machine numeric keypad.

- ✓ Security is provided by an embedded security module with state-of-the-art features that prevent unauthorized software from being executed in the machine. Likewise, attempts to run the official software on uncertified hardware result in the cancellation of the execution.

- The vote counting results are transmitted using VPNs, satellite communication (BGAN) and the WAN network of the Electoral Justice.

- The total vote counting results are made available to the public through a website using worldwide content distribution network.
  - Security against DDOS attacks
  - Protection of institutional websites from hacking attacks.



Transparency and Auditability

- Public Security Tests;
- Audit of the Source Codes;
- Sealing procedures of the systems, digital signature and disclosure of digital summaries (hashes);
- Associative Tables;
- Seals in the electronic voting machines;

- Integrity Tests;
- Voter's Biometric Identification;
- Digital Registration of the Vote (DRV);
- Pre and Post-Election Audits;

Evaluation of ICT Usage

"Relevant Results"

- Fraud elimination in three core phases:
    - Vote casting
    - Ballot counting
    - Tallying of results
- Results are reported/disseminated very quickly;
- No ballot boxes to store (but we do have the voting machines to store and maintain);
- Significant increase in confidence in election results and, as a result, reinforcement of our democracy and of the stability of the country.

New times, New challenges

- There have been new challenges in the horizon:
    - Conspiracy theories related to the use of EVMs
    - Disinformation campaigns
    - Worldwide decrease in the belief of science and engineering

New approaches are needed

- Information campaigns targeting the common citizen
- Press training; fact checking
- Simple, direct communication

BRAZIL – AT A GLANCE

Total Population	214.5 Million
Total Voters	156 Million (53% Women)
Total EVMs (Stand-alone)	577,000
Per Unit Cost of EVM	USD 1000 $
Total Polling Stations	460,000
Biometric or ID Card	Authentication
Voters' mandatory age	18-70 Years compulsory (16 & 17 and above 70 or illiterate are optional)
Penalty, in case not to cast vote	US 0.70$ (Fine)
Overseas Voters' can cast vote	President election only (Using 2,228 EVMs abroad)
Poll Workers	2.2 Million
Political Parties	32
EVM built first and then law was framed	Year 1996
EVM Type	DRE (Direct Recording Electronics) with built-in Biometric Verification feature
Brazilian EVM pilot tested by	Costa Rica, Ecuador, Paraguay, Argentina, Mexico
EVMs used by	Brazil, Switzerland, Canada, Australia, USA, Peru, South Korea, Venezuela, Philippines, India
VVPAT *(Voters' Verified Paper Audit Trail)*	NOT USED, *only paper trail showing stats of vote count, not the ballot in order to protect the secrecy of ballot.*
EVM Controversy?	VVPAT may be used according to opinion of few Political Parties.
Voting Time	8 a.m. to 5 p.m. (Local Time)
Persons with disabilities (blind, etc.)	Audio
Public inspections of EVMs	Six months before poll
Public inspection of EVMs by	Judiciary, Journalists, Govt. officials, Army, Navy, Airforce, Police, Reps from political parties, Intl. Org members, etc.
How to justify the vote absentee?	e-Titulo Mobile App or in person
Capital City / Currency	Brasília / Brazilian Real
Early voting / Mail Voting	No
Result Announcement	Within few hours
Municipalities	5,568

ABOUT BRAZILIAN EVM

(DRE Technology)

The machine records votes by means of a ballot display accompanied by buttons or touch screens to directly record the voter's choice by using digits like 90, 91, 92 etc. inside Direct Recording Electronic voting machine. The machine records votes electronically only and no paper trail (VVPAT – Voters' Verified Paper Audit Trail) is generated. The machine transmits individual ballots or vote totals to the Central location immediately after the close of poll.

Brazil is one of those countries that deployed EVMs nationwide to conduct one-day poll in country. They used EVMs for the first time in Municipality Elections in the year 1996. Key government entities like the National Institute of Spatial Research (INPE), the Brazilian Army, the Brazilian Air Force (Department of Aerospace Science and Technology – DCTA), the Brazilian Navy, and the Center of Telecommunications Research and Development (CPD) contributed to the design of the machine. The Tribunal Superior Electoral (*TSE*) finalized the equipment specifications and issues a bid tender for companies to compete and manufacture the voting machines. A TSE team built and implemented the software that runs on the EVMs for recording and counting of votes. Today, there are approximately 550,000 EVMs available across country for about 460,000 polling stations. The current model costs USD 1000 $ with service life of 10 years.

FEATURES OF THE BRAZILIAN EVM

The Brazilian EVM includes a voter's identification and authentication unit using biometric scanner to scan fingerprints. The ballot-casting unit is used to record the actual votes. The machine uses separate memory cards to store recorded votes, total votes and backup data respectively. The total votes are printed on machine bulletins using thermal printers, like receipt printers used in ATMs. However, it must be noted that these machines only print the totals, once the voting time ends and not the paper trail of individual votes cast by the voters. Batteries that ensure machine functionality is not disrupted in the event of a power outage also support the machines. The system has an audio output for voters who are blind or visually impaired.

RESEARCH ANALYSIS ON BRAZILIAN EVM

1. It has been observed that there are several layers of security that prevent invasion by third parties and access to information contained in the device. If an attack is attempted, it causes a reaction in the system that hangs the program and prevents it from being executed by an outsider.

2. On voting day, the balloting system is not connected to the internet or the TSE system. Consequently, there is no way to access or to invade it, remotely. The equipment works only at the time and date of the elections, normally from 8:00 am to 5:00 pm.

3. Since 2009, the TSE has organized mandatory Public Security Tests (PSTs). The PSTs are attended by specialists, and in the presence of staff from Electoral Court of Justice, members and representatives of political parties, journalists, members of international organizations, Brazilian Federal Police and Brazilian Army for building trust and confidence in the machine as well as in the whole ECO System of electronic voting.

4. Another inspection procedure carried out is to select certain EVMs on the eve of the election and proceed with a simulation of the votes at the headquarters of the

regional electoral courts. It happens with the participation of representatives of the candidates, with cameras filming the process, there is a verification process to ascertain the votes corresponding to those registered in the machine.

5. The possession of national capacity to produce EVMs not only reduces cost of EVMs but allows for flexibility in modifying the functionality of the machines. Brazil has constantly and easily migrated to higher models with 7 models deployed between 1996 and 2014.

6. The TSE regularly funds research aimed at improving security of elections. To illustrate this, a hacking competition was organized in 2009 to demonstrate the high security of the systems and create additional confidence in the technology. In 2011, new biometric-based voting machines were developed. They started implementing biometric identification in the electoral process in 2012 onwards.

7. There is a legal provision for participation of the Brazilian Bar Association, the Public Ministry and political parties in the various stages of specification and development of all computer programs used in the EVM. In addition, all technologies are indigenously developed in the Brazil.

8. Six months before each election, the system is opened for verification to several institutions, such as political parties, the Public Prosecutor's Office, the Federal Police, universities, and professional associations. The objective is to verify the programs that will be adopted and to make it open to criticism.

DECISION MAKING PROCESS ON ELECTRONIC VOTING BY BRAZIL

Brazil began shifting toward electronic voting in 1994 - 1996. The impulsion for the initial move to e-voting was largely led and managed by the Tribunal Superior Electoral (TSE). The TSE has jurisdiction over all aspects of elections in Brazil and regulates the functioning of political parties. Over its history, the TSE has developed a reputation for trustworthiness, competence and autonomy in the management of the electoral process. In addition to its election management role, the TSE is also responsible for revising the electoral law every two years and submitting it to the legislature for approval, as required by Brazilian law.

There were two primary reasons why the TSE adopted electronic voting machines (EVM). The first was to combat widespread fraud in the paper ballot tabulation process. The second was to address issues related to electoral accessibility and spoiled ballots in the paper voting system. Due to Brazil's complex electoral rules, voters regularly have to choose from thousands of legislative candidates. This makes results tabulation a logistical challenge because the paper voting system involves hundreds of thousands of vote counters who were often government employees from State-owned banks or the postal service. Because of the scale of the task, vote counting could take weeks and this post-election period was a time of great uncertainty and tension.

Most importantly, the lengthy tabulation period increased opportunity for vote counters allied with candidates to manipulate the vote count because the lengthy vote count was difficult for partisan and other civil society actors to fully monitor. The most common type of fraud was manipulation of the tabulation sheets known as "maps" where vote counters who were allied with candidates would subtract votes from one candidate's tally and add them to the favored candidate's count. This type of electoral fraud became a national issue after the 1994 presidential and legislative elections when a scheme to manipulate the election results involving electoral judges was uncovered in Rio de Janeiro. The local branch of the TSE was forced to annul the results for the legislative elections and hold a new one, leading to questions about the occurrence of fraud in elections. A secondary motivation for switching to

electronic voting was due to accessibility problems in the paper-based system. This system was a hugely complicated, as it required voters to write in the name or identifying number of their preferred legislative candidate. Two factors, the large number of candidates in legislative races, as well as the level of illiteracy in the country (approximately 20 percent, according to the 1990 census) resulted in almost 40 percent of votes being blank or invalid in 1994 legislative elections. These factors were compounded by the fact that, in legislative elections, voters voted for multiple offices and would fill in several names or numbers to cast votes for all offices. TSE officials argued that the high number of blank votes cast could be attributed to illiterate voters, who did not want to take a long time writing in a name, revealing they could not write. The disenfranchising effect of complex ballots also made fraud easier. If an illiterate voter doesn't know how to read or write, how can he vote? They humiliate themselves at the moment in which they vote. When he goes to the polling booth and he doesn't know what to do, he casts a blank vote. This vote, in the majority of places, is filled out by those committing fraud. It is by this means that fraudulent votes are cast in so many places. The initial decision to switch to electronic voting was made by President of the TSE in 1994. He cited the Rio de Janeiro scandal as a factor: In light of the challenges faced, not only in the most impoverished areas but also in one of the country's key cities like Rio de Janeiro, one must not shy away from the necessity of automation. If automation isn't feasible, then the "mechanization" of the voting process becomes imperative.

The motivation to change voting technologies came almost wholly from within the TSE, and was based in part on previous positive experiences with the use of technology in voter registration and results tabulation. When the decision was made between 1994 and 1995, there were no other major group of actors such as political parties, CSOs or other government bodies advocating for the abandonment of paper ballots.

In Brazil, a pilot was never been carried out to test electronic voting. Instead, a gradual introduction of universal electronic voting was achieved over the course of three elections: in the 1996 elections, 30 percent of voters (33 million) directly voted through the electronic voting machines; in 1998, an additional 30 percent (35 million voters) voted through e-voting machines; and in the 2000 elections, the entire nation voted through electronic voting (100 million voters).

Building the System for Electronic Voting and Counting

At the end of 1994, feasibility committee composed mostly of notable judges, lawyers and other jurists to investigate the feasibility of transitioning to electronic voting, as well as to determine the basic parameters of any new system. The committee was charged with planning a system with the following characteristics:

- Computers used for both voting and counting
- Could be used across a representative sample of municipalities throughout Brazil in the 1996 municipal elections
- Performed automatic and rapid tabulation of the votes
- Significantly reduced or eliminated fraud
- Implemented with the approval of citizens, political parties and candidates

Legal Framework

The TSE's feasibility committee crafted language to be included in legislation governing the 1996 municipal elections. Overall, the committee sought to create a system that would necessitate as few changes to existing law as possible. The legislature, with little debate, incorporated the legislative language into Articles 18, 19 and 20 of Law 9.100, which passed on September 29, 1995. The law authorized the TSE to use electronic voting, but did not specify in great detail how the system would work. The law required that voters choose a candidate by inputting their preferred candidate's number, and that each mayoral candidate's photo be displayed on the screen. The law also mandated that 120 days before the election, the TSE would allow political parties or companies hired by them to audit the code used in the machines.

Finally, Law mandated that a paper trail be created. A physical copy of the vote would be printed so the vote count produced by the machine could be checked using the hard copy. However, the law did not require that voters be able to verify the printed version of their vote with their selection on the machine.

Requirements for a voter verified paper audit trail (VVPAT) have undergone several reversals since the initial law governing electronic voting was passed. During this time, the TSE has been opposed to a requirement for VVPAT, but the Brazilian

Congress has attempted to introduce this requirement several times. In 2002, Congress passed electoral law 10.408, which mandated that the TSE begin transitioning to a system with a voter verified paper audit trail (VVPAT) and that this be piloted in the 2002 national elections. The TSE argued that the pilot results suggested the VVPAT system increased error rates and re-introduced some of the problems associated with the paper system. Civil society advocates of VVPAT argue that the TSE failed to adequately train poll workers and educate voters about VVPAT, thus stacking the deck against it use.

In 2003, at the behest of the TSE, Congress passed law 1.503, which removed the requirement to adopt VVPAT, instead mandating that each machine record individual votes in a random order. This record would be given the parties so they could tabulate individual votes and check the official vote count. Of course, this digital registry of individual votes does not provide the same level of verifiability as the VVPAT, as voters have no means of verifying their vote.

In 2009, the status quo changed once again. Representatives of the Working Democratic Party (Partido Democrático Trabalhista or PDT) successfully included language in Law 12.034/09 passed that year, which once again mandated VVPAT by the 2014 elections. Further, the new law required that voting machine not be connected to the other machines that verifies voters' identity. The TSE challenged the law in the Supreme Court, which suspended the said law because if the voter identification machines and the EVMs were not connected, then it would be possible for a voter to vote multiple times. The Supreme Court also expressed concern that if the printer jammed, then polling workers might see the vote while fixing the printer, compromising the secrecy of the ballot. While it is possible the suspension could be lifted on appeal, however, civil society activists favoring VVPAT are not optimistic.

Design Requirements

In the initial design stage, the TSE feasibility commission determined the basic parameters of the new system. While the commission mostly consulted with stakeholders within the government, they also reached out to outside experts at several computer companies, including IBM, Hewlett Packard, ABC-Bull, CPM, Unisys, Microsoft, Digital and Soza International. Dr. Camarão also examined existing commercial systems and observed elections in the state of Virginia in the

U.S., which employed electronic voting. The committee concluded that existing systems developed in other countries were insufficiently tailored to the requirements of the Brazilian elections, and consequently decided to seek a custom solution.

The initial requirements of the TSE committee for the electronic voting machine were as follows:

- Easy installation process
- Easy to operate, both by voter and poll worker
- Low cost and ability to be adapted to other uses
- Own source of energy so that external power sources would not be required
- Robustness to different weather conditions
- Machine should be controlled by poll workers to prevent multiple voting
- Machine should have attached printer to enable paper trail
- Printer ballot should be collected automatically without any action by the voter
- Voting machine should not be connected to a network for security reasons
- Equipment should allow for future upgrades
- Screen should allow voter to verify their vote and be capable of presenting instructions
- Screen should display each candidate's photo
- Allow for ability of the voter to use an alphanumeric keyboard to select candidates; this requirement was later abandoned in favor of a purely numeric keyboard. The TSE thought that since knowledge of how to use telephone keypads was widespread, a numeric keypad would not pose any difficulties for the illiterate and semi-literate.

With regard to the procurement process, the initial requirements were as follows:

- Equipment needed to be provided with enough time to conduct a full battery of tests under diverse conditions.
- The company providing the machines had to have the technical and logistical capacity to fully meet the needs of the TSE.
- The contract would cover hardware provision, as well as technical support, logistical support and aid in distribution.

Voter Education

The TSE hired private firms to conduct voter education for the first implementation of EVMs in 1996 through mass media including television, radio and print media. Local state courts were in charge of local campaigns, which included demonstrations of the new technology, lectures and mock elections. Civil society did not provide any voter education campaigns.

The TSE has continued the use of mass media as a voter education tool prior to all subsequent electoral events. Poll workers are also trained to help/sup- port voters during voting. The machines are designed to facilitate voting for handicapped or marginalized groups. For example, the machines are equipped with earphones for deaf voters and the keypad has Braille. Poll workers are trained to explain the voting process to the voters, if necessary.

Opinion polling since 1996 has shown strong positive evaluations of EVMs. Local polling in 1996 showed high levels of awareness of the change in voting technology. In recent years, the TSE has hired independent polling firms to measure voters' evaluation of the system. According to the TSE, 94 percent of voters polled positively evaluated the electronic voting system.

Election Day Procedures

Poll workers are responsible for organizing polling on the Election Day. They are responsible for the equipment and reserve equipment. Civil society groups generally do not observe Election Day procedures. Political parties, in contrast, send representatives to polling places. This practice is not universal, as not all parties have the size and organization to observe elections widely. Larger parties are more likely to have widespread observer representation at polling stations.

At 7.30 a.m. on Election Day, the president of the precinct turns on the e-voting machine in front of representatives of the parties, as well as the other poll workers. The e-voting machine prints out a zero report, called "*zeresima*" which certifies the ballot box is empty, i.e. that there is no candidate with a pre-assigned number of

votes. No other tests at this stage of elections are allowed. Consequently, no reports are made. According to the political parties, their representatives at the polling locations do not have the technical capacity to check the system properly during Election Day. Close-out procedures for Election Day are as follows:

- At 5:00 p.m. on Election Day, the president of the precinct uses his or her password to close the voting machine and print a voting machine report for the precinct. This report contains: precinct's identification code; voting machine's identification code; number of voters who attended and voted; and total voting results for each candidate.

- Five copies of the report are printed. These five copies are signed by the president of the precinct and representatives and inspectors of political parties. One copy is displayed announcing the results of the precinct. Three copies are sent to the Electoral Committee. The last copy is delivered to the Political Parties Committee. If required, the machine can print out five additional copies that can be distributed to the district attorney of the political parties, representatives of the press and the public prosecution office. The copy delivered to the Political Parties Committee is extremely important, because it allows parties to check whether the data have been modified during transmission. Upon data reception, the TRE and the TSE send an electronic receipt to political parties.

- The voting machine program saves the data on a diskette in an encrypted format to prevent data modification. The diskette is delivered to the local electoral committee.

In case of problems, each polling station has the additional reserve e-voting machines to replace the failed one. If no replacement voting machines are available, a paper ballot is used.

Tabulation

Once the polling is over and the polling place is closed, the data from the e-voting machine is then decrypted and uploaded with what is called a "guiding program." The process varies according to the type of election. In the case of municipal

elections, the data is tabulated at the precinct of the municipality and transferred to the local TRE and the TSE. In the case of general elections, the data are read at the precinct that corresponds to the municipality and transmitted to the local TRE and to the TSE. The data on votes for the President of the Republic are added and announced by the TSE.

The entire system is ensured by a security infrastructure, which prevents data from being intentionally or unintentionally modified and/or deleted. The security of the system is comprised of the system audit program, which records all transactions performed on the machine, and the system security program, which prevents any tampering with the voting machine, such as the removal of the diskette on which election votes are stored.

Challenges and Recounts

Since the implementation of electronic voting, no recounts of the results have been carried out in Brazil due to the lack of a VVPAT. As a consequence, there have been no successful challenges of election results. In case, if candidates have challenged results and requested a thorough vote audit, the TSE has responded by stating that the candidate would need to pay over $1 million USD to finance such a recount

Debates over VVPAT

As discussed, there have been several legislative attempts to introduce VVPAT to voting machines, but each attempt has been strongly opposed by the TSE, and legislation has either been repealed or the courts have suspended implementation. While civil society and political parties are generally supportive of using VVPAT, the TSE's opposition has thus far blocked the introduction of VVPAT. As of late 2012, there is a reform initiative by some deputes on VVPAT is in the Chamber of Deputies but, overall, there are not strong advocates for VVPAT in the legislature. Given the strong opposition of the TSE, this may mean VVPAT will not be implemented in the near term.

There are many reasons for opposition to the VVPAT, including the cost of introducing this mechanism; the damage that might be caused to the paper and printer in the heat and humidity of many places in the country; and the voter secrecy

implications, given that the individual and unique number of each voter would be printed.

There is a small movement in support of VVPAT in the social media space. An example of this type of initiative is a movement. These initiatives are not very influential, but interviews with stakeholders indicate the issue of VVPAT will return to the agenda of the legislature.

Post-Election Audits and Evaluation of the System

After each election, the TSE conducts an evaluation of system performance, but they are not conducted by independent bodies. The TSE is responsible for evaluating the system. Stakeholders have no formal role in the evaluation process. No public reports about the evaluation of the system have been issued. Even the political parties are not given reports about the process of elections by the TSE.

Lessons Learned

Key findings, key issues, considerations and lessons learned from Brazil's experience are summarized hereunder:-

Legality

- Although Congress formally creates the rules governing elections, the TSE is by far the most powerful actor in designing legislation governing elections. Usually when Congress has passed legislation contrary to the preferences of the TSE, the TSE has successfully convinced Congress to repeal the legislation or convinced the Supreme Court to suspend it.

- The institutional structure of election management in Brazil makes it difficult for external actors to independently influence and evaluate the use electronic voting. This stems from the fact that the TSE both implements elections and adjudicates electoral disputes. This arrangement creates a clear conflict of interest, since the TSE's own actions are often involved in any disputes involving election technology. This problem is further exacerbated by the fact that the only judicial body higher than the TSE, the Supreme Court, is partly composed of ministers of the TSE. As a result of

this institutional architecture, it is virtually impossible for outside actors to successfully challenge decisions made by the TSE through the legal system.

Accountability

- While the TSE has taken steps to make electronic voting accountable, these steps have not completely addressed issues of accountability.

- Robust forms of external auditing and evaluations are not provided. Opportunities to examine the source code or other aspects of the system are highly controlled and, given the complexity of the system, insufficient time is given for adequate vetting of the code and related systems.

- There is no practical way for political parties or candidates to dispute election outcomes, primarily due to the lack of VVPAT. Despite repeated attempts of congressional actors to modify the system to include a VVPAT, the TSE has successfully resisted such changes.

- Given these factors, some stakeholders have pointed out that greater access for non-governmental actors to examine or audit source codes would be beneficial for the election process in Brazil, and would enhance accountability of electronic voting.

Security and Secrecy

- In comparison to the paper ballot system, where fraud was relatively widespread, electronic voting has substantially improved the integrity of the vote count. The vast majority of electorate and political elites view the system as reliable and trustworthy, although there are some exceptions, particularly in the academic community.

- However, the limits placed by the TSE on full audits of the source code, equipment, and election outcomes breed distrust amongst academics and civil society groups interested in government transparency.

- Critics of the system have pointed out several potential flaws with the encryption and software verification mechanisms, but the TSE rarely

responds to these criticisms directly, which lowers trust in the system among interested parties.

- Most of the TSE's security efforts are aimed at protecting against an external attacker. Critics of the system argue that an internal attacker is also possible and that the TSE has not adequately described safeguards against such an attack.

- The voter verification system is linked to the voting machine, which is against international best practices. Congress attempted to sever this link through a change in the law, but the TSE succeeded in convincing the Supreme Court to suspend the law. The TSE argues the link is necessary to prevent voters from voting multiple times.

Transparency

- While the TSE states it is transparent during some parts of the electoral process, this is not always sufficient in meeting international best practices and gaining the trust and confidence of key stakeholders.

- In some cases, transparency was restricted because of sensitivity and secrecy of information, particularly with regard to access source code. When external parties have access to the source code, basic tools used to test and search the code are not permitted.

- Most importantly, no independent observers are allowed to observe the electoral processes in Brazil. Civil society organizations have to work through political parties to gain accreditation as observers. Only the OAB has access as an independent organization, but it claims it does not have sufficient expertise to assess the processes fully.

- In the experience of Brazil, there are no challenges and recounts carried out, as there is no VVPAT. Even though the trust of citizens and political parties in the system is very high, this does not guarantee a fully accountable process.

- The vast majority of non-governmental interviewees recognize the need of

VVPAT for Brazil elections and there have been legislative attempts to introduce VVPAT.

Sustainability

- Since 1996, Brazil began implementation of electronic voting in a staged manner. Beginning in 2000, all elections have been fully electronic and EVMs are accepted by all stakeholders.

- Since 1996, the country has built over 16 years of experience in electronic voting and, as a result, has very few problems associated with EVMs. Error rates are very low; although some modifications were made, the same basic system adopted in 1996 is still in use.

Inclusiveness

- The development of electronic voting in Brazil was somewhat inclusive in 1996, and involved input from technology experts and vendors; it still lacks sufficient input from non-State actors.

- The voter education in Brazil seems to be effective, as polls show that voters have sufficient levels of information on the electoral system and on usage of electronic voting machines, and electronic voting retains widespread support among Brazilian voters.

- Electronic voting has greatly improved inclusiveness for low literacy voters. After the adoption of electronic voting, the fraction of blank and invalid votes has dropped dramatically, as the new system has proven easier to use than the paper ballot system.

Trust

- Most parties and voters trust the electronic voting system and rate it highly, particularly the fact that it produces results quickly and reduces uncertainty over election outcomes.

- A few political parties, civil society activists and members of academia view the TSE as too closed and unaccountable. This distrust stems mainly from the fact that attempted reforms to introduce voter verifiability have been blocked by the TSE. Highly-restricted access to the electronic voting

source code also contributes to this mistrust.

- A range of stakeholders, including civil society activists and academics, contend the TSE would be well-served to open up the electronic voting process for further auditability, and explore ways VVPAT can be introduced in a cost-effective manner.

TYPES OF EVMs

(A Global Perspective)

Electronic voting is not a new phenomenon. The first widespread use was in the USA, in the 1960s when punched card systems were used. Below are different voting technologies currently used in different parts of the world, including United States, Brazil, India, Philippines and Canada.

A) Direct Recording Electronic (DRE) Voting Technology

Brazilian DRE

First DRE in the US developed 1991 consortium of state bodies

The machine records votes by means of a ballot display, which may be accompanied by buttons or touch screens to directly record the voter's choice, hence the name Direct Recording Electronic voting machine. The machine records votes electronically only and no paper trail is generated. The machine may transmit individual ballots or vote totals.

Deployment and Price Estimate: It has been used in the USA and Venezuela. Currently Brazil is the country with a nationwide deployment of machines, each machine price estimated to be around USD 800 $ to 1000 $.

Pros	Cons
Cost efficiency due to elimination of paper	Typical example of a black box that depicts lack of transparency
Eliminates rejected votes or invalid votes	No guarantee of EVM software honest or bugged and functioning properly
Quick result compilation	No paper trail for auditing

B) Precinct Count Optical Scanning (PCOS) Machines

PCOS Machine in Philippines, used in 2010 and developed by M/s Smartmatic

Ballot papers are marked using a pen / marker, a digital pen or an electronic marking device. These marked ballot papers are input to the Optical Mark Recognition (OMR) based scanning and counting device. OMR is the same technology used to mark standardized tests. This can be done at each precinct, or all the marked ballots can be collected at a centralized location for the tabulation, in which case the system is called central-count voting system.

Deployment and Price Estimate: Precinct Count Optical Scan (PCOS) systems are deployed in Philippines, with price estimates of each unit costing around USD 1600 $.

Pros	Cons
Marked paper ballots enable audits to be carried out	Marked paper ballots are susceptible to traditional risks, such as ballot box stuffing, and ballot destruction
Faster speed of tabulation	Numerous machine malfunctions have been reported.
Paper legacy will continue for ease of voters	Marking on a specialized ballot may be cumbersome. Requires excessive awareness.
Quick declaration of results at the polling stations. It works as counting machine	Voter training and awareness required to help them mark ballots. Possibility of invalid votes remains there.

C) DRE Voting Technology with VVPAT

Indian EVM with VVPAT

In the direct-recording electronic voting machine, the voter has no guarantee that their vote was recorded as cast. This makes the voting process opaque and lacks the guarantees to convince stakeholders of a free and fair election. The DRE-VVPAT voting machines, along with recording the vote, produce a paper print out of the vote. This printout can be inspected by the voters, to verify their vote was cast as intended. This Voter Verified Paper Audit Trail (VVPAT) can then be inserted in a ballot box automatically, straight from the voting module or manually by the voter.

Deployments and Price: DRE-VVPATs are used extensively in the USA and nationwide in India for national level elections. The Indian model has an estimated price of USD 300 $.

Pros	Cons
Voters press button for casting vote directly into an electronic device	Requires excessive awareness & training
No invalid votes	Life of thermal paper is always limited then it became fade with the passage of time. The paper trail is only useful when post-election audit carried out.
Fully Auditable system due to VVPAT	The paper trails are susceptible to destruction & ballot box stuffing.
Quick declaration of results	Highly costly in terms of logistics and transportation. Storage issues and use of more human resource in order to handle it.

D) Public Network connected DRE (Direct Recording Electronic)

Developed in US by Votronic

ExpressVote XL by Election Systems Software (ES&S)

Such machines transmit the recorded electronic ballots and transmit vote data from polling stations over a public network, such as the internet. Vote data may be transmitted as individual ballots, periodically as batches of ballots throughout the election day, or as one batch at the close of voting, and are generally tabulated centrally.

Deployment and Price: These machines have been used in Switzerland, UK on an experimental basis and approx. USD 2,000 $ or plus per unit cost.

Pros	Cons
Voters mark their vote directly into an electronic device	High-end secure network is needed for safe voting and it's very expensive and always prone to hack due to public network connectivity.
No invalid or rejected vote	Depicts lack transparency, fragile machine and is not rugged that can be used in difficult terrain such as desert, mountains and under extreme temperatures.
Quick results compilation	Lack auditability features

E) EVM with Paper Ballot

EVM in Bangladesh, assembled by Bangladesh Machine Tools Factory after importing parts

The voter marks his choice using a button on the machine, which produces a token, or a paper print out of the vote. This printed ballot is then placed in a ballot box either automatically by the voting machine or manually by the voter. At the end of polling, all of the tokens/ballots are manually counted.

Deployment and Price Estimate: These machines have been used in Belgium and Bangladesh. Bangladesh is spending USD 2,400 $ per machine.

Pros	Cons
Voters mark their vote directly into an electronic device	Manual counting may lead to human error
Paper trail VVPAT allows audits to be undertaken	Thermal paper with limited life. Ballot stuffing and spoiled ballot
Instant result declaration	Very costly and huge logistical overheads.

FREQUENTLY ASKED QUESTIONS
(RESPONSE OF SECRETARY (IT), TSE, BRAZIL)

(1) Who took this initiative for introduction of EVM in the country – Parliament or Election Management Body, Superior Electoral Court?

The motivation for electronic voting began with the attempt to defraud the Rio de Janeiro state governor election, in 1982 – known as the Proconsult scandal. At that time, there were several “methodologies” to defraud paper ballots and make changes in the tally lists of precincts out of reach of party inspectors. There were numerous requests for cancellation of election results and for vote recounts, leading to an increased delay in the publication of election results.

The first action that can be considered an initiative by the Supreme Court and the Superior Electoral Court was the national enrollment of voters, which did not exist before 1986. The second action was also an initiative of the Supreme Court and the Superior Electoral Court. It was the project of an electronic voting machine, in accordance with the constitutional principles of the 1988 Constitution. This project began to become a reality in 1996. Finally, all of this only happened after political sensitization among people and their representatives about the need for clean elections. Thus, Elections Law was enacted in 1997, approved by the National Congress.

(2) How many types of elections it catered for in one time?

There are two types of elections: local and general. In local elections, there are 2 positions in dispute: (1) mayor and (2) councilor of municipalities (cities). In general elections, there are 5 positions: (1) president, (2) governor, (3) senator, (4) federal deputy and (5) state (or district) deputy. Local elections take place every 4 years. General elections also take place every 4 years, but never simultaneously. Therefore, every 2 years there is an election: a local election and a general election. For example, in 2024 there will be a local election. In 2022 there was a general election.

(3) What is life of EVM?

The life cycle of an EVM is 10 years, as specified for its acquisition. However, there were models of EVMs running for 12 years before they were properly decommissioned.

(4) Indigenous vs out sourcing of EVM? Dependency on machine vendors can create a possibility for electoral fraud due to hardware, software, support and maintenance. How did you handle such challenge (Indigenous development Vs Import from abroad)?

Brazilian EVMs are already entirely manufactured by third parties. Only the hardware purchase specifications are indigenous as they need to comply with constitutional principles. Therefore, while the EVMs are being manufactured, there are inspections to ensure that these principles are being met and that the specifications are being followed, as promised by the supplier in the purchase contract. On the other hand, the operating system and all applications present in the EVMs are developed internally, under strict control of the TSE. In other words, the EVMs' software is indigenous.

(5) Is there one day poll or staggered elections in Brazil?

As defined by electoral legislation, voting throughout the country must begin at 8 am and end at 5 pm, unless there is a problem that requires it to end a little later. The legislation also requires that elections be simultaneous.

(6) What is EVM controversy?

Societies around the world share very different values from each other. In some cases, the secrecy of the vote is very unimportant, as the rights are so guaranteed by the State that its citizens do not need to fear that someone will prove who they voted for. On the other hand, there are cases in which the coercion for votes is so intense that, if their votes are revealed, they may suffer sanctions from employers, family members or neighbors, for instance. In the first case, voting could even be done in an arena, in the form of an assembly. In the second case, the vote must be secret to protect the citizen from any type of coercion.

Therefore, the controversy lies in whether the State can guarantee that its citizens are not coerced when voting, including by agents of the State itself. The Brazilian electoral system and, as part of it, Brazilian EVMs were planned and built to protect citizens from any coercion.

Nowadays, political forces that benefit from coercion, to gain even more power, protest against electoral authorities so that they can have more "freedom" to coerce.

(7) Why VVPAT (Voters' Verified Paper Audit Trail) is not been used as vote for transparency?

The Brazilian Constitution has a set of unchangeable provisions and one of them is that the vote must be secret. There is concern that relying solely on paper trails may not fully guarantee the secrecy of the vote. Physical records, which are stored and guarded by humans, may be susceptible to interference or manipulation, potentially compromising vote secrecy.

In Brazilian EVMs, the vote is digitally recorded, but in a completely scrambled way. Each vote, when registered, in addition to being scrambled, receives a digital signature from the EVM itself, which contains a cryptographic perimeter with internally generated and non-exportable keys. Furthermore, many other pieces of evidence are created that meets the need for auditing and traceability, but always safeguarding the secrecy of the vote.

(8) What are the electoral systems (majority / proportional)?

There are two types of electoral systems: majority and proportional. The majority system is used for positions in the executive branch such as the president, state governors, and mayors, as well as for senators in the legislative branch. On the other hand, the proportional system applies to legislative positions in chambers, including federal, state, and district deputies, as well as councilors of municipalities.

(9) How much time does it take to nation-wide implementation? Adoption of technology in haste is the negation of Election ECO system and standards, how much time was it take to for nationwide?

The implementation was phased. The main factor to choose the cities where the electronic voting would be firstly implemented was the infrastructure (basically energy and communications). The state capitals and cities with more than 200,000 voters were so chosen as the first step,

in 1996. After, in 1998, state capitals and cities with more than 40,500 voters. In 2000, the first electronic election nationwide in every poll station.

Therefore, since the first electronic election, 4 years. However, if we consider the national and digital voter registration (1986) as the first event, 14 years.

(10) How to ensure ballot secrecy?

In Brazilian EVMs, the vote is digitally recorded, but in a completely scrambled way. Each vote, when registered, in addition to being scrambled, receives a digital signature from the EVM itself, which contains a cryptographic perimeter with internally generated and non-exportable keys. Furthermore, other pieces of evidence are created that meet the need for auditing and traceability, but always safeguarding the secrecy of the vote.

(11) How to enforce voters' anonymity?

Brazilian EVMs do not record the association between vote and voter identity. Although each EVM has a fingerprint reader, it is only used to confirm voter presence and to prevent one voter from voting for another. Confirmation that there is no such association occurs in source code audits, which take place before each election and which are open to inspection by governmental control bodies (e.g., federal police, audit court) and by researchers from Brazilian universities.

(12) How to confirm transparency, especially without paper trail?

Brazilian EVMs issue reports on voting and their operation. The two main reports issued by the EVM are the zerésima and the BU (results bulletin). The zerésima is a bulletin issued when the poll station starts its work and shows that all registered candidates have no votes. The results bulletin (BU) is issued when the voting at a polling station is completed and shows the numbers of votes for each candidate and party for that polling station. The RDV (record of votes) is a table where the votes that occur in that EVM were recorded in a scrambled manner. At the end of voting, the results bulletin (BU) is recorded on a media inserted when the EVM received the

data of candidates and voters. This media is the one whose data will be transmitted, after being removed from the EVM. On the same media, the final RDV is recorded and could be audited, if necessary.

Another important confirmation of transparency is the Integrity Test of EVMs. A set of EVMs drawn at random just before voting begins are removed from their polling location and taken to another location (sometimes even by helicopter). In this other location, another voting takes place with recorded videos of several votes defined by the auditors. The recorded videos are used to compare the results report (BU) issued by the EVMs under test and the one counted manually by checking the videos.

Before each election, a Public Security Test (TPS) takes place. In this test, EVMs are delivered to attackers, who submit attack plans to a committee. These plans are evaluated and if approved, the attacks are implemented under the supervision of the TSE. When an attack is successful, they are patched and to confirm the patch, the attack occurs again to verify that the patch worked. All of this occurs in a public, transparent manner and is widely publicized.

(13) How many number of pilot testings were performed?

The first Brazilian EVM, in 1996, was completely designed by a commission designated exclusively for this purpose. Before that, different commissions established for these specific purposes defined the premises for an EVM (e.g. robustness, resilience, easy to transport) and the procedures for using an EVM in an election. The designed EVM was then tendered and acquired in sufficient numbers for the first local elections to take place (which are simpler, as there are only two positions) and which took place in capitals and cities with more than 200 thousand voters. In other words, there were no pilot tests without voters. The purchased EVMs were directly used in elections.

It is important to highlight that certainly the definition of all procedures for a fully digital vote was the reason for it being successful, even without pilot tests. These procedures defined in detail what should be done if problems

occurred, mainly in the event of a failure in an EVM that required voting to be returned to paper at a polling station.

(14) How to assure and ensuring security? How to protect chain of custody during machine at rest and transportation? How to protect from hacking and tempering of machines? How to prevent alteration in software to manipulate EVM? What method you use to detect honest & dishonest machine before poll?

For the safety of EVMs, there are two basic conditions: (1) it must be safe, even when opened and disassembled; (2) it should not have network connections (Wi-Fi or even Ethernet). Unfortunately, these two conditions are the opposite of what constitutes security in most consumer equipment. Since, it is an embedded equipment, it was decided in 2008 that the EVM's motherboard must have a cryptographic perimeter (embedded on the board itself) responsible for its identity, initialization, and cryptographic operations. Furthermore, some critical peripherals also have a cryptographic perimeter to ensure secure communication between them and the motherboard. Today, such peripherals are voter numeric keypad, printer, and fingerprint sensor.

For identity purposes, the TSE has a physical and logical infrastructure of certification authorities (CA) which guarantee the integrity, inaccessibility and authenticity of the non-exportable keys generated by the EVMs during their manufacture. Furthermore, the hardware of EVMs is uniquely identified. Each EVM, upon being received at its storage location, goes through a process of recognizing its identity and cryptographic keys.

For initialization purposes, cryptographic parameters are used to ensure that EVMs can only be turned on if they have been recognized after being received at their storage location. EVM software, including the BIOS, the bootloader and the OS itself, can only run on the EVM if it has been digitally signed by cryptographic parameters present in the EVM's cryptographic perimeter.

For cryptographic operations purposes, the cryptographic perimeter must provide cryptographic operations for operations that may be considered critical.

Therefore, if an EVM is dismantled or has its hardware tampered with, it will not work and possibly not even turn on.

The TSE makes extensive use of crypto operations to ensure the security of every election stage. This applies to the transmission of results, to the totalization, to the registration of voters, to the divulgation of results, to the registration of candidates and others.

(15) What is per unit cost of EVM with other financials for maintenance, etc.?

The most recent manufactured EVM (model 2022) had a unitary cost of US$ 1,150.00. The maintenance is US$ 1.28 by EVM/month.

(16) What is overall cost implications between paper ballot and EVMs?

Unfortunately, the monetary cost of different voting systems would have very difficult and possibly imprecise estimates, mainly for comparison purposes since the processes are very different and include immaterial values such as voting security and vote secrecy.

(17) How legal amendments were made? Was there consensus amongst all stakeholders while opting EVMs?

It could be said that historical coincidences occurred that benefited the adoption of digital voting and consequently the legal changes. Brazil underwent a process of democratization beginning in 1984 and the drafting of a new Constitution, which was promulgated in 1988. Brazilian society was also receptive to reforms that would bring legal certainty and several laws were being regulated precisely because of the new Constitution. Even so, the old Electoral Code, from 1965, which structured elections was reformed to accommodate digital voting and the Elections Law was enacted, which regulates schedules, legal deadlines, procedures, and rites for each election separately.

(18) What are the procedures to make overall setup auditable and verifiable?

i) Development of EVM software in compliance with standards and guidelines for the development of secure software.

ii) Scheduled and frequent testing of hardware and software long before the elections, to detect, in addition to defects and errors, potential vulnerabilities or threats.

iii) Wide availability of EVM source codes for verification by interested and legally qualified entities and authorities.

iv) The Public Security Testing system used to assess / detect vulnerabilities and threats of EVM which takes place during election days.

v) Digital certification of the cryptographic parameters of EVMs, to ensure their authenticity, secure boot, even if their hardware is tampered with.

vi) Digital signatures of EVM software by stakeholders and external auditors and subsequent verification on the EVMs themselves before running these software.

vii) Digital signatures of all EVM issued artifacts such as the results bulletin, zerésima and the digital votes registration (RDV) and subsequent publication of these artifacts and their respective digital signatures, using the cryptographic parameters of the EVM itself.

viii) EVMs Integrity Tests, which take place right before the elections, choosing them, at random (draw), to be tested in a public session, whose voting videos are recorded to compare whether the results are the same as those entered into it by present people.

(19) What are tools to detect electoral fraud inside polling station (if occurred)?

At the polling station, the EVM is located behind a booth, but its back is visible to the poll worker and his assistants who can monitor any malfunctions.

The flow of voters is fully controlled by the poll worker in his own terminal where he starts voting by making the EVM available to the voter and then receiving the information that the voter has finished voting.

When receiving a new voter, the poll worker has a book with photos and information about the voter, which can be used to check the voter's face with the photo in the notebook and the identification document brought by

the voter. The voter is then invited to place their finger on the fingerprint sensor and, if recognized, voting will begin on the EVM voter terminal. If the voter is not recognized, he can still be released, but the poll worker needs to put his fingerprint to do so and then start voting.

All polling places are monitored by a designated judge, who receives any complaints of attempted fraud observed by the voters themselves or by poll workers.

Poll workers can require voters not to take their smartphones or any other artifact that compromises the secrecy of the vote into the booths. If he/she offers resistance, the poll worker may request help from the police to stop him/her.

The most common occurrences are related to attempts to tamper with the EVM's numeric keypad with glue or some inked brush, attempts to photograph his/her own vote with a smartphone (to prove alleged vote buying), simulate some EVM malfunction to accuse the electoral authority itself of fraud, and more rarely, instance of setting fire to the EVM or entering the cabin armed and shooting at the EVM.

(20) What is logistical / operational plan to conduct one-day poll in country? The conduct of free, fair, credible and transparent elections may be difficult as per Constitution due to introduction of technology in haste. Public trust and confidence will remain shaky. What approach you followed to handle this challenge?

Several factors contribute to the election taking place simultaneously across the country, for various disputed positions, on a single day.

The first factor was undoubtedly the promulgation of Elections Law, in 1997 (https://www.tse.jus.br/legislacao/codigo-eleitoral/lei-das-eleicoes/lei-das-eleicoes-lei-nb0-9.504-de-30-de-setembro-de-1997). This law determines all procedural rites for candidacies, resources, obligations and that the elections must be simultaneous and take place on a single day. It also determines how long an EVM must remain open receiving votes from voters.

The second factor is the existence of a judicial structure replicated in each of the federative units (TREs), which, in turn is divided into electoral zones, covering part of a municipality or more than one. This judicial structure is centralized in the TSE and allows decisions to flow quickly and in an evaluated manner from the center to the end and vice versa.

The third factor is the continuous voter identity enrollment, since 1986. After each election, every 2 years, the database of enrolled voters is opened again to receive new entries and then closed shortly before the new election. Today, the database of enrolled voters can operate a bank of more than 150 million voters, including those individualized by a biometric identity database of Brazilian citizens.

The fourth factor is what we call Candidates Enrollment and Preparation. At this stage, before the elections, at a time determined by the Elections Law, candidates and parties insert their information, via the internet, in systems designed specifically for this purpose. Such records (including candidates' photos) are stored in a database and published in a website. At the end of the candidates' enrollment period, they are recorded on several physical media (USB memories) that will be used to insert such data into the respective EVMs. This insertion will consider the locations and jurisdictions of each candidacy, so that the EVM contain only the data significant to that location. Almost simultaneously, physical media (USB memories) are recorded with voter data (including biometric data) of each EVM. This recording will consider each voter's voting locations. In other words, each EVM will only receive a specific set of voters. The Preparation stage is carried out under the supervision of electoral judges at certified workstations.

The fifth factor is related to the EVMs. The Brazilian EVMs, since 1996, are fully specified by the TSE, acquired after a bidding process, and then manufactured under strict supervision by the TSE. Once manufactured, EVMs are distributed and not just before elections, except in justified cases. The EVMs distribution within regionals follows their own guidelines. As soon as the EVM arrive at the region to be stored, it is registered as a

TSE asset and go through a process of digital certification of the security hardware inside the EVM's motherboard. This certification process ensure that the voting software will be running only on an authentic ballot box. It should be noted that care is taken to ensure that: (a) EVMs are maintained in sufficient numbers to meet possible contingencies (no more than 1% in the last election, for the newer EVMs and no more than 3% for the older EVMs); (b) EVMs are periodically subjected to preventive maintenance; (c) EVMs that are found to be defective are repaired; (d) EVMs have a lifecycle of ten years. After that, they are sustainably discarded. Another observation is that the EVM voting application does not require the voter to make difficult decisions during voting. In other words, voting must be fluid so as not to delay the end of voting. Each voter's identity is biometrically verified each time he/she presents himself/herself to the poll worker, thus preventing them from voting two or more times. Once the voting end time has been reached, in accordance with the elections law, a physical medium (an USB memory) is removed after the poll worker prints, using the EVM, a report containing the voting results for that EVM. So, he/she publishes it on a wall or door from the polling place itself.

The sixth factor is the sum of data from all EVMs, followed by the application of the rules defined in the electoral law. This application of the law to the results is what defines the winners and is called Totalization. Once the result is defined, it is widely publicized on a TSE website, via a web system. This same website, while the summing takes place, also publishes the partial results. For the result to be released on the same day, massive processing is required on multiple servers with multiple processors. Both for the Divulgation of Results and for other web systems related to the election, because of the large number of simultaneous queries, performance and security appliances are necessary, as well as replications of the TSE websites in the cloud. In other words, a seventh factor is the IT infrastructure so that elections can take place smoothly.

This process described above is repeated continuously every 2 years, constantly with the incorporation of corrections and improvements, since 1996 (28 years).

(21) What procedures you followed for voter education, public awareness based on literacy rate?

The voter education is mainly based on media advertising campaigns and social media presence, both made by the TSE (Superior Electoral Court). Moreover, the candidates receive an airtime for advertising in the main open communication vehicles (radio and TV), to talk about their plans and to spread their voting numbers. Furthermore, the candidates make printed tip notes to the voter take it to the voting machine and copy the numbers.

Each candidate has a different number with between 2 and 5 digits, depending on the hierarchy of his/her disputed charge. Every voter must enter the candidate number in a 0-9 numeric keypad whose push-button keys positions are the same of the telephones and ATMs. Each party has also a number which is part of the candidate number.

For PwD, the push-button keys have raised dots (Braille code) that can be read with the fingers by blind people. The backside of voter terminal has an audio output where can be plugged an earphone to listen to him/her interaction with the keyboard (the numbers being entered).

Although the Brazilian people speaks only one language (Brazilian Portuguese), we have a wide variety of cultural and literacy characteristics. So, the voting machine has a standard user interface. The more literate person uses the same user interface which the less literate. The Amazonian and the Carioca citizens use the same voting machine. So, the standard user interaction is with the same 0-9 numeric keypad. The candidates and parties are identified by numbers that are advertised in campaigns before the elections.

According to the Election Law, the poll staff must be 18-years older, be a valid voter and not be relative to any candidate. Although there is not a law to rule the grade of literacy requirement, the returning board member must be literate (able to read/write) and, if the region has more availability of graduated people, they are preferred.

In conclusion, voters only need to memorize their candidate's number. If the voter has low literacy (for example, can only understand numbers) he/she will not need to write anything, but just type in his/her candidate's number.

(22) Processes are dependent on an international or national tech firm (if any), how to guarantee independence of EMB?

No. Critical processes are under exclusive control of public servants. When any specific skill is not available within the court, it is possible to hire civil servants from other bodies to carry out the task to be performed. There are private companies hired that carry out operational tasks, even those related to security. However, in this case, their activities are strictly monitored by public servants.

(23) How to produce authentic digital evidences in case of disputes?

Brazilian EVMs generate an event log, which provides rich evidence. Additionally, there is an evidence trail using digital signatures and artifact encryption. Within the cryptographic perimeter itself, there is evidence that can be used in possible disputes. Another very powerful source of evidence is the identity of the EVM. However, in a legal dispute, the police authorities are granted access to the exportable cryptographic parameters. They can prove or refute any suspicion using forensic tools such as forensic duplicators.

(24) Absence of dust-free, humid free and controlled temperature environment in warehouse, how to store these EVMs?

As Brazil is a very large country with a diverse climate, also for logistical reasons, the EVMs are stored regionally, in each state. So, each Tribunal Regional Electoral (TRE) branch defines its storage method and distributive strategies. However, all of that must be based on parameters defined in technical standards issued by the TSE. These standards define appropriate storage conditions (e.g. temperature, humidity, way of stacking and moving, electrical installations). The TRE adapts its facilities to ensure service and conservation of equipment.

(25) How to perform training to the poll staff? What are the mechanisms for training at all levels using EVMs?

Poll workers are selected based on education and skills, information recovered from the voter registration database. Learning to operate the EVM while the voting day is not complex, but it requires literacy and agility. The poll staff training is basically based on distance learning platforms, whose contents are demonstration videos of the beginning and end of voting and how to deal with problems that may occur. EVMs are equipped with batteries that can sustain operation for 10 hours. However, if the EVM shuts down due to some failure, there are instructions on how to proceed, either restoring its operation or replacing it with another contingency EVM. The training is also concerned with providing poll workers with the ability to multiply the acquired knowledge. Under specific conditions, such as the Covid-19 pandemic, special instructions are given in training. For instance, taking care of hygiene, wearing masks and keeping your distance from others in the voter line.

(26) Learning curve is required for operators, what are the parameters to pick such officials and train them?

To talk about the learning curve, it is necessary to list who interacts with the EVMs. Firstly, voters, who interact with a very intuitive user interface. Despite this, for voters, this training can be provided through television advertising or the Internet. Secondly, the poll workers, who have special training through distance learning. For those who maintain the voting machines, in general, there is specific software that offers detailed diagnoses, and the training is basically to be able to read and understand these diagnoses or read and understand the logs generated and recovered. Finally, for digital certification procedures, there is also very intuitive user interface that easily guides operators to the end.

(27) How did you gain public trust and confidence using EVMs?

In the early days, massive campaigns were carried out on how to vote for EVMs, especially in schools. But there was a predisposition from society.

A side benefit of elections with EVMs was the possibility of counting being very fast and consequently the results being published very quickly.

Although this was not an initial objective, it was realized that this quick result prevents the emergence of conflicts caused by uncertainty and doubts.

The very rapid results divulgation causes, to this day, a great gain in confidence among the population, even though we know that this is not rational.

(28) How to bring trust of the stakeholders, Civil Society Organizations (CSOs), NGOs, Media etc.?

The keyword here is participation. They were all called to participate in committees to define procedures, to inspect the application of the procedures, to design the EVM, to communicate with the people. This involvement continues to this day.

(29) EVM cannot prevent issues and electoral frauds like booth capturing, low women voter's turnout, misuse of state authorities, electronic ballot stuffing, vote buying, law & order situation, dishonest polling staff, wide spread political and electoral violence, abuse of state resources by incumbent parties, how to handle such challenges?

EVMs are just a small part of an entire complex process. EVMs do not exist to solve all problems.

(30) These machines are not off-the-shelf product, therefore, it requires frequent technical challenges, what are those challenges and how did you resolve it?

As always, the biggest challenge is dealing with uncertainty caused by errors or breakdowns. This is resolved, on election day, with contingency EVMs. To meet the contingency needs of the entire country, it is generally necessary to purchase 10% more EVMs.

If the EVM fails, it can be replaced by another EVM, which receives the data from the media (pen drive like and for older models, compact flash) coming from the failed EVM and proceed the voting at the polling station. The contingency EVMs needs to be specially prepared to receive information of a specific group of polling stations.

Some states prepare 30% of all EVMs as contingency, others prepare only 8%. It depends on the territorial extension, lack of infrastructure (roads, railways, ports, airways, telecommunications facilities etc.). The contingency EVMs are the backups. They are strategically placed around the voting places.

Each election shows us lessons learned that must be accumulated to avoid repeating mistakes. Therefore, here are some of these lessons learned related to EVMs;

i) The LCD display based on organic components are degradable. Therefore, it reduces the EVM life cycle. Newer models no longer have this type of LCD. But even on newer models, LCD displays are critical.
ii) The media based on flash memories (pen drives and compact flashes) commonly has compatibility problems. The procurement of this type of supply must be based on very strict specifications.
iii) The security seals must be effective to evidence frauds, but also to be cleanable on the EVMs cabinet.
iv) To avoid failures, the poll workers are not supposed to be smart. All the procedures must be clear and easy to explain and easy to perform.
v) The EVMs supplies must be purchased in advance. The providers must be known in advance. It is preferable there be several providers for a supply product.
vi) Although the EVMs have embedded security hardware to ensure the software running there, it should be advisable to map all the electoral process, to ensure, for instance, that every voting machine loaded with data before the election and used during the voting (contingency voting machines, included) had a valid result.
vii) Monitoring the supply stocks. In general, keep a safety stock for each supply product (batteries, empty cabinets, media, spare parts etc.)
viii) Monitoring the EVMs life cycle. There are two types of maintenance: corrective and preventive. The corrective maintenance consists of fixing (and recording) any problems. The preventive maintenance

consists of periodical activities to conserve and prevent problems. For instance, the lead-acid battery must be charged every 4 months – preventive maintenance. By the other hand, to replace a broken LCD panel (not misused) – corrective maintenance.

(31) Germany, Holland abandoned due to lack of transparency and absence of VVPAT (Voters Verified Paper Audit Trail)? How did you make such steps wherein there is no paper trail?

EVMs should not be adopted as consumer equipment. Several countries have already fallen for this story and have banned computerized elections as a result. The Dutch case is typical of this error. Elections should not be seen as something that can be outsourced nor should their control be delegated to external agents to the country. In the Netherlands, there was the adoption of consumer EVMs (Nedap), which could be purchased without any specification as they were supposedly ready. These EVMs were stolen, and several tests were carried out on it. As a result of testing, terrifying vulnerabilities and threats emerge. At that same moment, Germany was considering adopting electronic voting. But after the events in its neighbor, the German Supreme Court decided to ban electronic voting due to lack of transparency, inclusiveness and other key election principles. The paper authored by Bart Jacobs and Wolter Pieters, titled "Electronic Voting in the Netherlands: from early Adoption to early Abolishment" tells this story well.

(32) Ireland, Italy and Finland abandoned due to lack of security, what security standards you followed to gain public trust and confidence in EVMs?

Resistance to electronic voting can arise from concerns about security and trust in the electoral process, especially in societies with strong social cohesion. Transitioning to electronic voting should be viewed as a stage in the evolution of democracy rather than its culmination. In countries like Brazil, where voting involves decisions beyond candidate selection, there's a recognition of the importance of civic engagement and political literacy. The debate over electronic voting should prioritize principles like transparency, accountability, and citizen participation.

WAY FORWARD

i) The importance of parliamentary involvement in the review and discussion of already submitted pilot project reports on Electronic Voting Machine (EVM) and Biometric Verification Machine (BVM) is imperative. Parliament could be again requested to initiate discussions and further deliberations on these reports, the statement emphasizes the need for thorough examination to finalize the specifications of these machines. This approach ensures that decisions regarding EVMs and BVMs are informed by robust discussions and considerations within the parliamentary framework.

ii) Paradigm shift from paper ballot to electronic voting necessitates the formulation of a national policy through amendments to the legal framework, developing secure technology, adapting procedures, establishing operational protocols, implementing administrative changes and assessing financial implications. Collaboration among all stakeholders, including the Parliament, Ministries, Government Agencies, major Political Parties, Civil Society Organizations, Media, IT industry and Academia is crucial and mandatory for a successful transition. Brazil and India took a similar approach.

iii) Political consensus amongst the parliamentarians and major political parties is the key to success before moving towards opting any particular technology;

iv) ECP may continue exploring different types of EVM technologies being used in real elections (nationwide) in other countries;

v) To timely counter disinformation, misinformation and fake news propaganda attacks against ECP, a dedicated team should be deputed to use all major platforms of social media;

vi) Official coordination or Memorandum of Understanding regarding content regulations may be signed with PTA (Pakistan Telecommunication Authority), Meta (Facebook), YouTube, WhatsApp, Instagram and X (Twitter), etc.;

vii) ECP may also consider developing more resilient comprehensive strategy for countering Disinformation, Misinformation and Fake News by taking a leaf from Brazilian Strategic Plan Model.

CONCLUSION

We believe that the introduction of election technology is a viable and promising option for enhancing trust and credibility of elections in the country. However, this transition must not be done in haste: adapting election technology to our unique ground realities in a secure, reliable, and cost-effective manner requires great care, effort, and deliberation on the part of stakeholders and considerable work on building a supporting ecosystem for the technology. Moreover, we must be cognizant of the key lesson from our prior experiences with election technology: we lack fundamental expertise in this domain and there are critical knowledge gaps in our discourse and strategy. We believe that it is vital to recognize and confront these shortcomings squarely.

If the project of Electronic Voting Machine is undertaken in a structured and systematic manner, with necessary due diligence by the Parliament, it will result in a landmark achievement towards ensuring credible and trustworthy elections in Pakistan. As per Section 103 of the Elections Act, 2017, the Pilot Projects are necessary to undertake while taking valuable input from the Parliament to proceed further. It is important to note that Pilot Project Reports on Electronic Voting Machine and Biometric Verification Machine had already been submitted in the Parliament and the response thereto is awaited.

The international experience demonstrates that success stories in EVM deployment, such as Brazil and India lie in adhering to a common formula. These nations have developed and introduced EVMs in a careful and systematic manner, taking careful heed of ground realities and international best practices, democratizing the process and engaging stakeholders in active consultation and encouraging evolution in the system design and features. Moreover, EVM deployment is an immense investment and indigenous development and production of machines tend to be far more cost effective and beneficial than importing expensive technology from abroad. This entire process can span years but provides a robust foundation for responsible use of technology and credible elections.

Amendments to the legal framework by Parliament, along with political consensus, are prerequisites before further progress can be made in this matter.

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STUDY VISIT TO BRAZIL ON ELECTRONIC VOTING MACHINES

Pictorial Document

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Mr. Sikandar Sultan Raja, Hon'ble Chief Election Commissioner of Pakistan presenting shield to Mr. Justice Alexandre de Moraes, President Tribunal Superior Electoral (TSE)

Mr. Sikandar Sultan Raja, Hon'ble Chief Election Commissioner of Pakistan receiving souvenir from Mr. Justice Alexandre de Moraes, President Tribunal Superior Electoral (TSE)

Joint photo session of Mr. Sikandar Sultan Raja, Hon'ble Chief Election Commissioner of Pakistan and Mr. Justice Alexandre de Moraes, President Tribunal Superior Electoral (TSE)

Joint photo session of Mr. Sikandar Sultan Raja, Hon'ble Chief Election Commissioner of Pakistan and Mr. Justice Alexandre de Moraes, President Tribunal Superior Electoral (TSE), sharing experiences between the two Constitutional heads of Pakistan and Brazil.

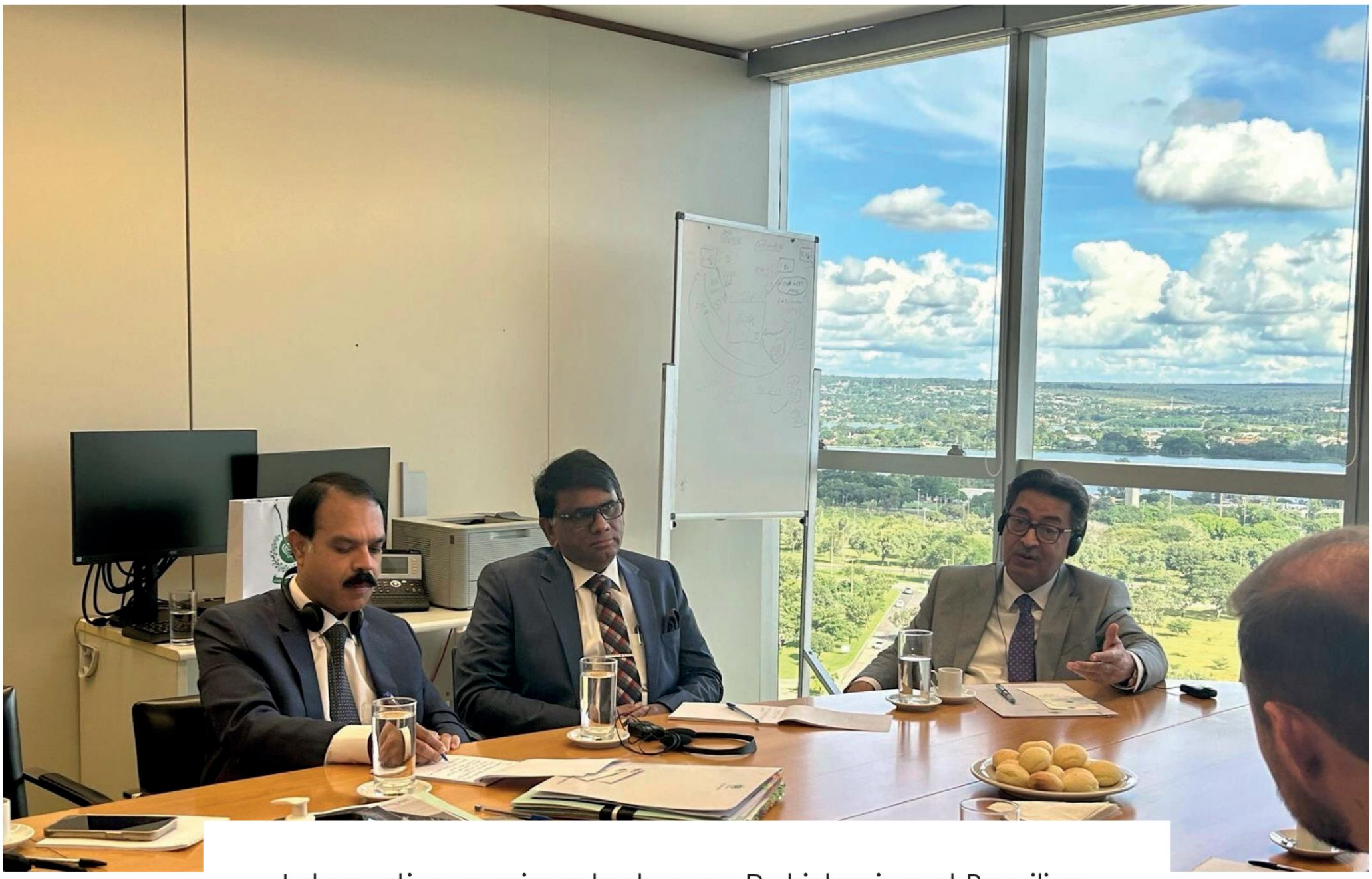
Mr. Sikandar Sultan Raja, Hon'ble Chief Election Commissioner of Pakistan presenting shield to Mr. Julio Valente, Secretary, Information Technology

Mr. Sikandar Sultan Raja, Hon'ble Chief Election Commissioner of Pakistan presenting shield to Mr. Taigo Wolf

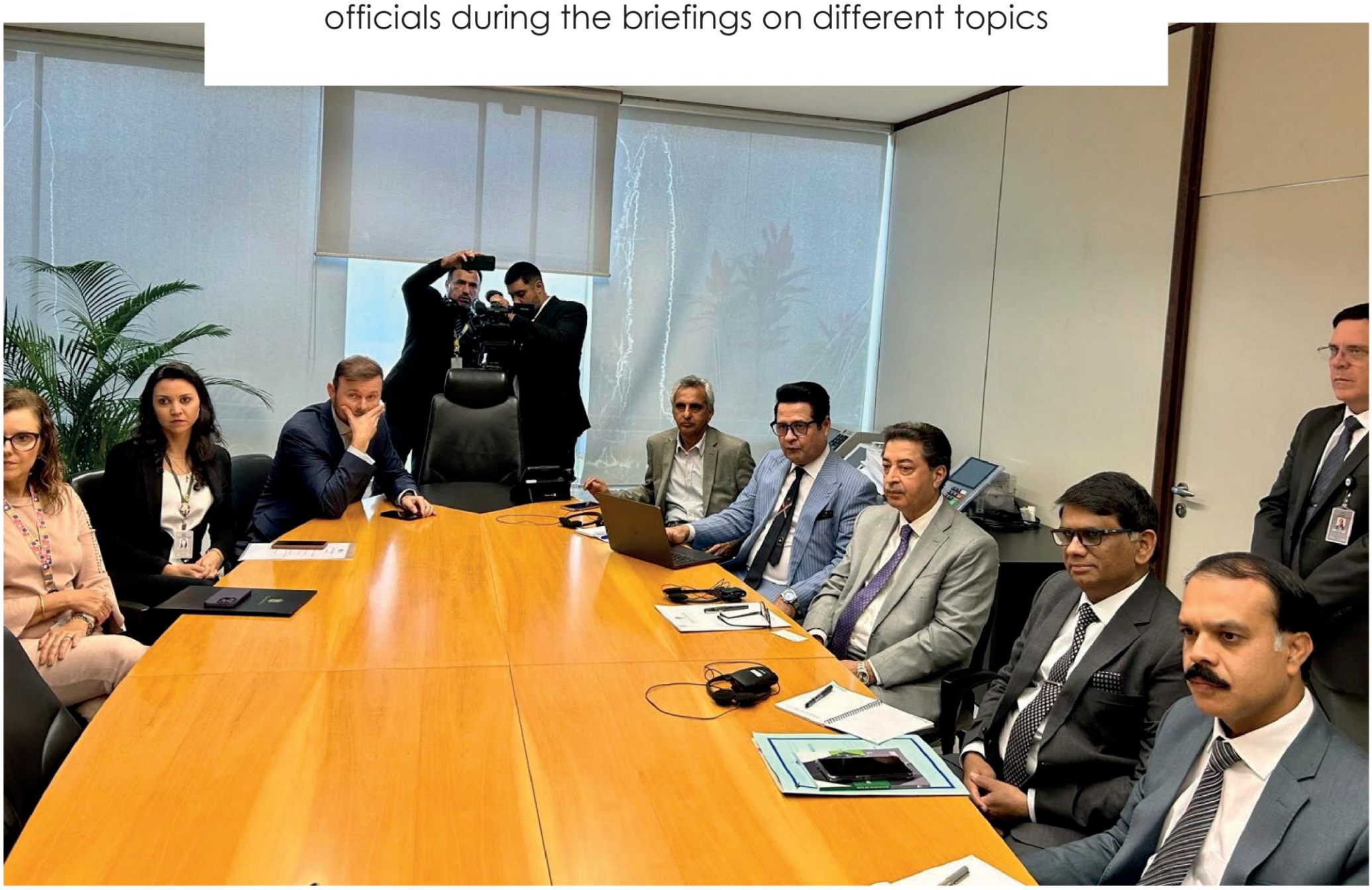
Mr. Sikandar Sultan Raja, Hon'ble Chief Election Commissioner of Pakistan presenting shield to Mrs. Marilia Loyola Barriero Rocha, Head of Advisary for Identification Management (AGI)

Mr. Sikandar Sultan Raja, Hon'ble Chief Election Commissioner of Pakistan presenting shield to Mr. Ahmad Hussain Dayo, High Commissioner

Mr. Sikandar Sultan Raja, Hon'ble Chief Election Commissioner of Pakistan presenting shield to Mr. Irfan Ullah Khan, Deputy High Commissioner



Interactive sessions between Pakistani and Brazilian officials during the briefings on different topics

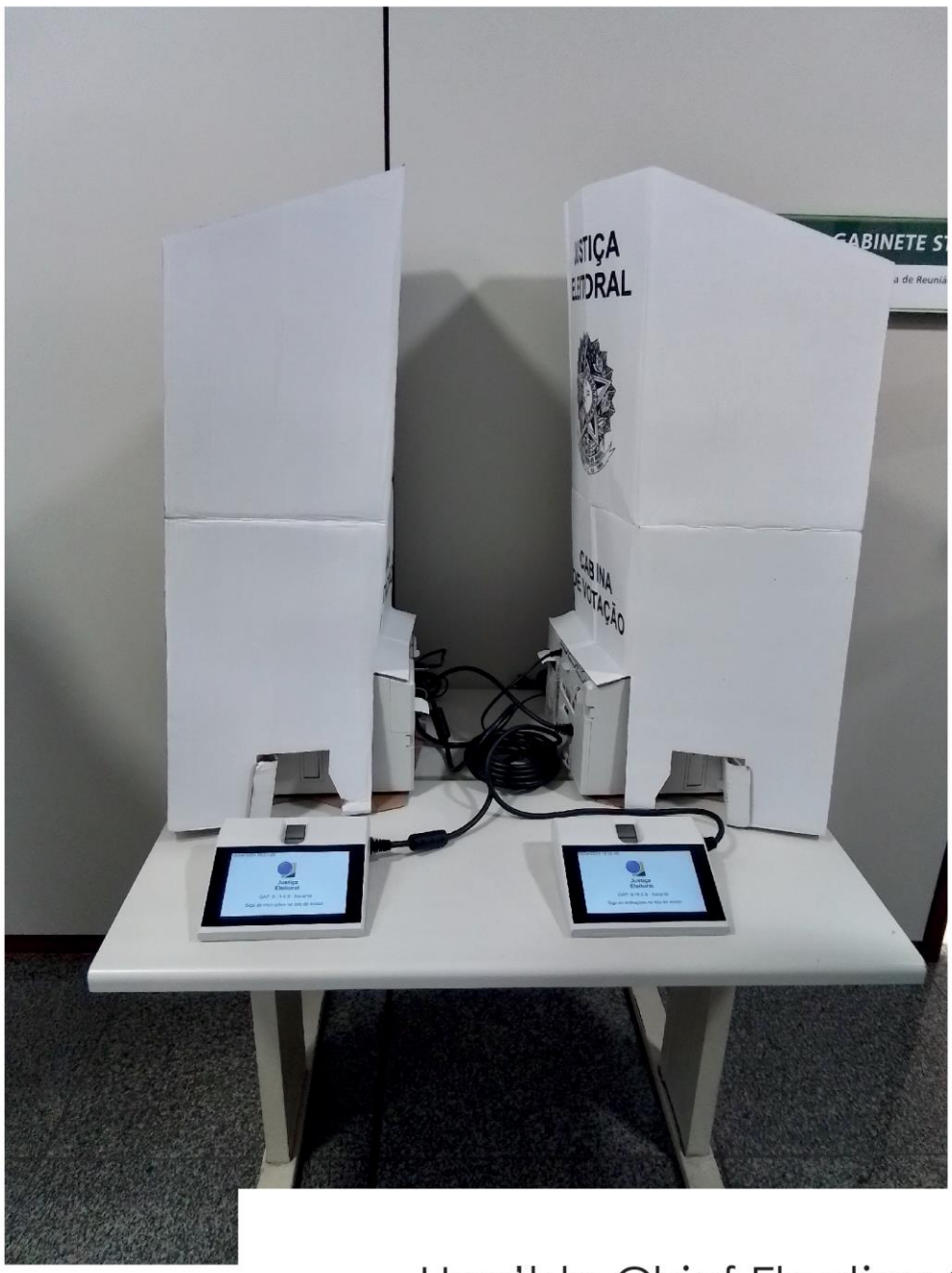


Discussions between Pakistani and Brazilian top officials during the briefings on Identifiction Management

Briefing on use of Multimedia and Communication Strategies to address Disinformation

Briefings on Combating Strategies against Disinformation

Mr. Sikandar Sultan Raja, Hon'ble Chief Election Commissioner of Pakistan visiting the court room of Tribunal Superior Electoral (TSE)

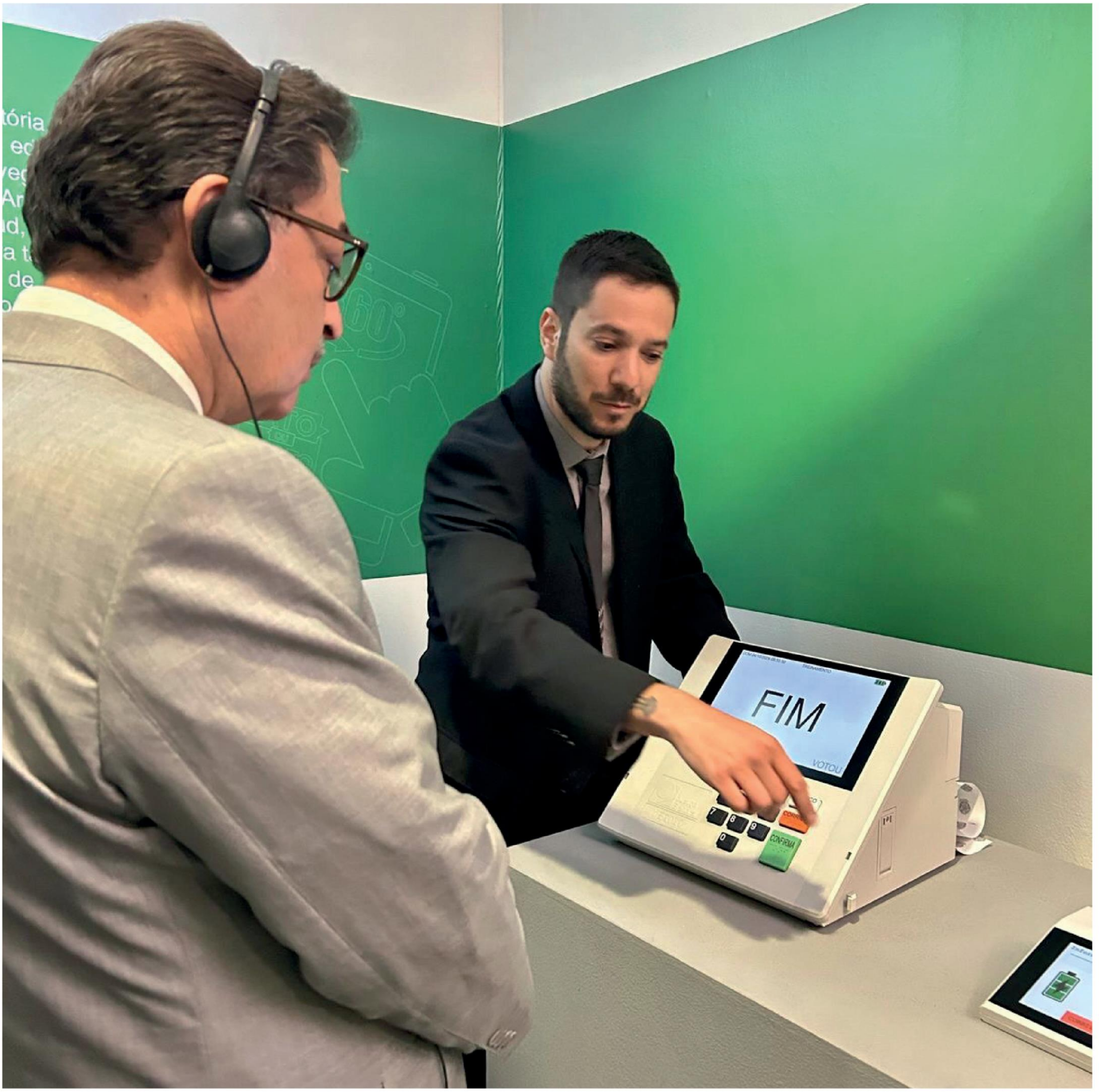


Hon'ble Chief Election Commissioner of Pakistan is witnessing Live Demostration of EVM from Secretary IT, TSE

Briefing on EVM from Secretary IT, TSE

Briefing on old polling procedures by TSE official in the Museum

Hon'ble Chief Election Commissioner of Pakistan is witnessing different models of all EVMs from 1st version to latest in use



Hon'ble Chief Election Commissioner of Pakistan is witnessing different models of all EVMs from 1st version to latest in use in the TSE Museum

Provincial Election Commissioner Punjab is casting vote
during live demonstration of EVM