ELECTRONIC VOTING IN THE DISTRICT OF ÉVORA

PORTUGAL

2019 European Parliament Elections

Final Report

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Index

Acronyms

CED	Dematerialised Electoral Rolls
VE	Electronic Vote
VT	Traditional voting
SGMAI/AE	General Secretariat for Home Affairs – Electoral Administration
MAI	Ministry for Home Affairs
SMS	Short Message Service
SIGRE	Electoral Registration Management Information System
SIGRE Web	Electoral Registration Management Information System, Web version
SIGRE Admin	Electoral Registration Management Information System, Administration version
CRRE	Electoral Results Collection Centre
SIAR	Input System of Voter Turnout and Results
PAEP	Platform of Support to the Provisional Scrutiny
PEP	Platform of the Provisional Scrutiny
PAVE	Platform of Support to the Electronic Vote
PIN	Personal Identification Number
VVPAT	Voter-Verifiable Paper Audit Trail
V.I.A.	Voting Interface Adaptor
UNC3T	Cybercrime and Technological Criminality National Combat Unit from the Judiciary Police
COSI	Operational Centre of the IT Security
CSIRT-MAI	Computer Security Incident Response Team from MAI
SOA	Service-Oriented Architecture

Structure

The present document is the final report on the implementation of the Electronic Voting in the district of Évora, in the context of the 2019 European Parliament Elections.

Firstly, we'll proceed to the presentation of the Electronic Voting scope and technical components of the Dematerialised Electoral Rolls, the correspondent equipment and support infrastructure (in terms of communication, security, and logistics) and of the support component for operation in a contingency situation.

Secondly, the actions taken envisaging the execution of the Electronic Voting, the definition of the tasks and goals, its main components (in particular, the training of the polling station members), the training monitoring and control methodologies, the training material, and the election day (European Parliament Elections of 2019) will be disclosed.

Lastly, there will be an analysis of the obtained results, knowledge acquired during the process, the conclusions reached by the several teams involved, as well as of the formulated recommendations.

Summary

The article 8th, nº 1, of the Organic Law nº 3/2018, of August the 17th, expressly states that the Secretariat-General of the Ministry for Home Affairs – Electoral Administration (SGMAI/AE) "*In the next electoral act for the European Parliament (…) may promote the implementation, as an experiment, of the Electronic Vote in person, in at least 10 national counties, being the votes casted during the tabulation of the results".* The implementation of the Electronic Vote in person and the dematerialisation of the electoral rolls are also contained in the Law nº 70/2018, of December the 31st, which has approved the Great Options of the Plan to 2019.

In conformity with the new attributions, the SGMAI/AE has initiated the execution of the necessary procedures to the accomplishment of the exercise of the right to vote in the electronic modality, creating, for that purpose, a pioneer system.

In line with the fundamental principles of our Electoral Law, the Electronic Vote was designed in accordance with the principles:

(1) **Officious and compulsory -** the system has guaranteed that the universe of voters for the Évora district was extracted from the database of the electoral registration.

(2) **Universality** – the system has covered all the citizens that are entitled to electoral capacity in the district of Évora.

(3) **Confidentiality of the vote** - the system has guaranteed absolute confidentiality of the orientation of the vote.

(4) **Unicity** - the system has ensured the respect for the principle "one voter, one vote".

(5) **Reliability** - the system has produced accurate results, which means that the votes counted must correspond to the vote orientation of the electorate.

(6) **Personal and on-site vote** – the system has ensured the respect for the articles 49th, nº 2 of the Portuguese Constitution, according to which "The exercise of the right to vote is personal and constitutes a civic duty" and 121st, nº3, also contained in the Fundamental Law, which establishes that "The right to vote on national territory is exercised in person".

The Electronic Vote was implemented in the district of Évora, and it involved the installation of 47 polling stations of Electronic Voting (a total of 94 informatic ballot boxes), in 25 Parishes from the 14 Counties of the District. In all the District the traditional ballot boxes were maintained.

Being so, the Electronic Voting polling stations, created in accordance with the law, functioned in an independent and additional way to the 185 traditional polling stations, allowing the voter to choose either the traditional modality or the electronic one.

The Electronic Vote was articulated with the project of the dematerialised electoral rolls (CED), which allowed the voter of the district of Évora to vote in any Electronic Voting section installed or in the traditional voting section where the voter was registered, as all the polling stations electronically shared a single centralised registration of the voter through the CED application, which was updated in real time as the electorate voted.

Due to the fact that it was a system of Electronic Voting and that was essential to guarantee its credibility and reliability, the system adopted the *Voter-Verifiable Paper Audit Trail* (VVPAT) model, issuing a supporting evidence of the vote in paper (in all similar to the traditional ballot paper), that was also folded in four by the voter and delivered to the president of the polling station to be introduced in a ballot box identical to the traditional one.

The Electronic Voting was integrated in the general organisation of the several electoral acts taking place in 2019, namely, the Election for the European Parliament, the Election for the Legislative Assembly of the Autonomous Region of Madeira of 2019, and the Election for the Parliament of 2019, having been established, for its accomplishment, an interdisciplinary working group, which integrated several public and private entities, organised in the following way:

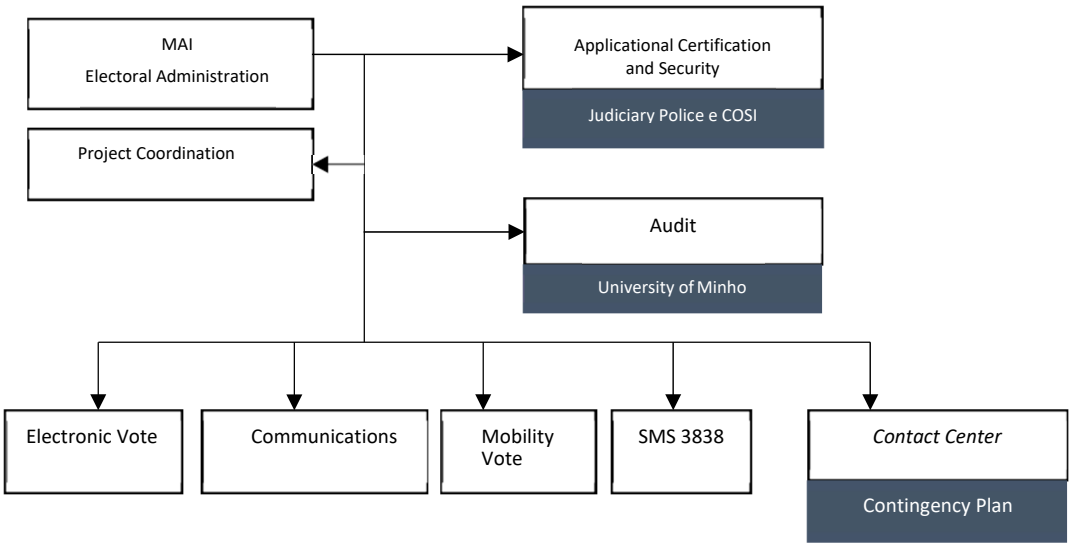


Figure 1 – Organisation chart

As the Electronic Vote involves a strong technological component and resorts to information systems, there was the necessity to ensure that the about 1.500 members of the polling stations (including the lists' delegates and the officials from the Parish Councils and Municipal Chambers) received the appropriate training to deal with those systems and associated procedures.

That training intended to vest the polling station members with the required technical competences and procedures to exercise the respective functions, both in the context of the traditional and electronic voting sections. This training took place in 20 places of the district, for 40 groups, in the following days: 11/05, 18/05 and 25/05.

From the procedures point of view, the functioning of the election day was the following:

- The system was initiated through a general verification of all the components to ensure its functioning (self-test), waiting for the opening of the electronic ballot boxes by the electoral authority. The opening of the electronic ballot boxes was done through the introduction of a Smartcard and of a personal identification number (PIN), attributed to the president and vice-president of the polling station. After the opening of the ballot boxes, the system was ready for the electorate to vote.
- To exercise his/her right to vote, the voter received from the president of the polling station a Smartcard, which enabled him/her to activate, in the cabin, his/her voting

session on the electronic vote equipment. Once the session was activated, and with the visualisation of the candidacies and of the voting options blank or void, the voter determined his/her voting intention through the selection, on the touch screen, of the respective option. After the confirmation of the voting intention and that the vote was properly registered, the system printed supporting evidence of the vote, which allowed the voter to confirm that that was his/her voting orientation. Following this, the voter folded the supporting evidence in four, delivered it to the president of the polling station, who placed it into the ballot box, and gave the smartcard back to the polling station.

- The system has also allowed the assisted voting, using earphones that indicated, through voice instructions, the steps to be taken to vote.

To support the training and the election day, several installations of net and communications, trainers, technicians of local support, technicians of communication, Contact Center (for the contingency plan), support teams of elections and of the pilot-project, security forces (GNR and PSP) and the Judiciary Police (PJ) – a total of 620 people -, were involved, directly or indirectly, both in Lisbon (TagusPark) and in Porto (Contumil).

Electronic Vote in the district of Évora	
Entities	**Average Number of Staff**
SGMAI/TIC (Information and communication technologies)	20
SGMAI/AE (Electoral Administration)	30
PMO (Project Manager Officer)	8
Service-providing entities	404
University of Minho	3
AMA (Agency for Administrative Modernisation)	4
Judiciary Police (PJ)	5
Security Forces (PSP + GNR)	95
INCM (Mint National Press)	5
CIMAC (Intermunicipal Community of Central Alentejo)	4
Municipal Chambers	42
Total:	**620**

Table 1 - Average of Staff per Entity

The election day for the European Parliament (26t^{h} of May) occurred with absolute normality, with only punctual situations (regarding the Electronic Voting) happening related to the failure of equipment, but which were rapidly solved, and the occurrence of some electric energy failures (especially in the County of Montemor-o-Novo), but which were of a very short duration.

Regarding the adherence to the Electronic Voting, the statistics allowed to conclude that from the total participation in Évora, 33,29% of the electorate voted in an electronic ballot section.

However, 74,6% of the ballot sections were traditional ones, and only 25,4% polling stations were electronic. This means that, in relative terms, the electronic polling stations had, in

average, more 97% of voters than the traditional polling stations.

	Traditional voting	Electronic voting
Polling Stations in Évora - total	185	47
% Polling stations over the total (232)	74,6%	25,4%
Average of voters by polling station	170	335

Table 2 - Comparison of the average of voters by voting section

These data are even more significant if we bear in mind the average age of the voter in Évora is high and that most of the population does not use information and communication technologies, in an intensive manner, in the daily life.

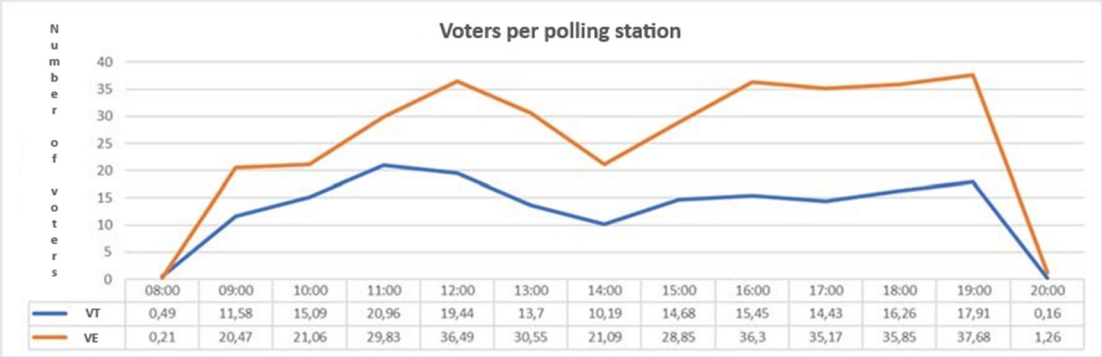


Figure 2 - Chart Representing Electronic Voting Participation

By the end of the election day, after the tabulation of results by the members of the polling station and once all the work was finished, every equipment of electronic voting, the president, vice-president and voting smartcards, the aggregation Compaq Flash and all the material of replacement were properly sealed by the members of the polling stations, as well as the ballot boxes containing the supporting evidence documents (also named "supporting document" and "voting receipt"). Afterwards, this material was transported by the security forces to the District Command of the Public Security Police, where it was kept at its guard and available for the Assembly of Intermediate Tabulation and under its president's order, who is also Chief Justice of the District Court of Évora.

After the publication of the official results by the National Elections Commission, the internal and external memory cards, which contain the operative system of the electronic voting equipment's, and the voting database, were removed from the equipment and placed in a sealed envelope, together with the respective president, vice-president or voting smartcard.

These components, as well as the supporting evidence documents, will stay under the guard of the District Court of Évora for the following twelve months, similarly to the rest of the material produced by the polling stations on the election day.

1 Electronic Voting in the district of Évora

1.1 Introduction

The legal entitlement of the Electronic Voting derives both from the Organic Law nº 3/2018, of August the 17th, and from the Law nº 70/2018, of December the 31st, which has approved the Great Options of the Plan for 2019 and which, in the context of "Civic and Democratic Participation", under initiatives of legislative change to strengthen the democratic participation in the electoral process, already approved by the Government, foresaw:

(1) The dematerialised electoral rolls.

(2) The implementation of the pilot-project on the Electronic Vote in-person in the district of Évora.

Therefore, the Electronic Voting was developed by the SGMAI in accordance with the legal mandate approved by the Parliament and in execution of Government's orders.

The governmental area of the Home Affairs Administration chose the district of Évora due to a set of requisites identified as essential to the viability of the initiative, worth noting:

(1) Bundle 14 municipalities having the district as electoral constituency (close to the 10 indicated in the article 8t^{h}, n. º 1, of the Organic Law n. º 3/2018, of August the 17th).

(2) Presenting a proportional distribution of counties and parishes, urban and rural.

(3) Having a universe of registered people with a good representation - about 137.000 registrations - between the counties.

(4) Having a significant number of registrations.

(5) Having a road network that allows any parish to be, at least, 60 minutes from the headquarters of the county and also from these to the capital of the district, allowing an essential support of logistical management to the implementation of the project; and the last, but not the least.

(6) The support and engagement of the Intermunicipal Community of Alentejo Central (CIMAC), ensuring, thereby, a privileged channel, but also a facilitator, near the Presidents of the Municipal Chambers and Parish Councils of the District, whose support and collaboration would be essential, as it were, for the success of this project.

The execution of the Electronic Voting implied the installation of 47 polling stations of Electronic Voting in 25 Parishes from the 14 Counties of Évora. The distribution of the Electronic Voting polling stations was planned and executed in permanent coordination with the municipalities, having in consideration the following criteria:

(1) Ensure, at least, the installation of an Electronic Voting polling station in each county.

(2) Guarantee to each voter the option of voting electronically or traditionally. Therefore, the electronic polling stations would have to be installed near the traditional polling stations.

(3) Ensure that the universe of the voters in the voting stations would have a dimension that would permit the unfolding in one or more additional polling stations.

1.2 Compulsory Requisites

The project of the Electronic Voting was designed, as already mentioned, in a way able to ensure the fulfilment of the general principles part of Electoral Law, namely, officious character, mandatory nature, universality, confidentiality, unicity, reliability, personal nature and on-site character.

In this sense, the Electronic Voting has strictly respected, with the necessary adaptations, the acts and procedures foreseen in the traditional voting modality.

In this regard, a set of mandatory requisites was identified, designed with reference to the respect for the general principles of our Electoral Law:

Officious and compulsory: the system must guarantee that the universe of voters for the Évora District is extracted from the database of the electoral registration. Article 113th, nº2, from the Portuguese Constitution establishes that "the electoral registration is officious, compulsory, permanent and unique for all the elections through direct and universal suffrage (…)" and article 3º of the Law nº 13/99, of March the 22nd – Legal Framework of the Electoral Registration – states that "Every national citizen, who is over 17 years old, is officiously and automatically registered in the database of the electoral registration, (…), and the respective information be

acquired through the interoperability of the Identity Card Services". The extraction of the universe of voters for the Évora district through the database of the electoral registration has guaranteed the officious character and mandatory nature that characterise the system of electoral registration.

Universality: to encompass every citizen who is entitled to active electoral capacity in the district of Évora. Article 49th, nº 1, of the Portuguese Constitution, states that "Are entitled to the right to vote every citizen aged over eighteen years old (…)" and article 2nd, nº 1, from the Law nº 13/99, of March the 22nd – Legal Framework of Electoral Registration -, stipulates that "The electoral registration covers everyone who benefits from active electoral capacity". Therefore, the effort to abide by this principle was made, however, considering, naturally, the appropriate scale (the scale of the district of Évora).

Confidentiality: to ensure total confidentiality of the voting orientation of each voter. In fact, article 1st, nº 3, of the Act Relative to the Election for the European Parliament (1976), in its current wording, states that "The election occurs through universal, direct, free and secret suffrage".

Article 113th of the Portuguese Constitution establishes that "the periodical, direct and secret suffrage embodies the general rule governing the designation of the holders of the sovereign elective organs, autonomous regions and local power". This Constitutional principle of Electoral Law, named electoral principle or democratic legitimacy principle, rules all the electoral acts taking place in Portugal.

To abide by this nuclear principle of electoral law, it was essential that the system could ensure the confidentiality of the vote orientation of each voter at three levels:

(1) Completes the separation between the vote the identity of the voter;

(2) Exclusive knowledge of the vote orientation by the voter himself;

(3) Total protection of the voter's data.

Unicity: to ensure that each voter only votes once and that in the electoral results is only considered one vote per voter, respecting the principle "one voter, one vote". According to the article 80th of the Electoral Law for the Parliament, it is expressly stated that "each voter can only vote once". In this sense, it was of cardinal importance that the system was able to guarantee that each voter could only vote once.

Reliability: to safeguard the achievement of accurate results. The count of the votes had to reflect in an exact manner the valid and legitimately expressed votes and the discharges in the electoral rolls had to reveal expressly the voters who had voted.

Therefore, the system needed to guarantee that the electronic voting machine used in the district of Évora: (1) would allow the voter to confirm his voting intention before submitting; (2) would provide a supporting evidence document, in paper and electronically submitted, allowing the voter to verify that the supporting document reflected his voting intention expressed through electronic means; (3) would guarantee that only the voters who had effectively voted be discharged from the electoral rolls.

As the tabulation of the European Parliament Elections results constitutes a national constituency, it was also decided by the governmental area of the Home Affairs Administration that all the voters from the Évora District could exercise their right to vote in mobility, being able to vote in any of the 47 Electronic Voting polling stations that will be installed.

Personal nature and on-site character of the vote: to guarantee the fulfilment of the Constitutional command enshrined in the article 49th, nº 2, which imposes the personal character of the right to vote and sets aside the possibility of legal or voluntary representation. To ensure the on-site character of the vote as the rule to exercise the right to vote in respect for the article 121st, nº 3, of the Fundamental Law.

In line with the previously mentioned, the Electronic Voting was executed in a way that would allow the voters to exercise their right to vote in one of the 232 voting sections of the district of Évora. To support the mobility of the voting, there was the necessity to dematerialise the

electoral rolls, allowing the members of the polling stations to consult and verify in real time if the citizen presented in from of them to exercise the right to vote:

(1) was registered in one of the voting stations in the district of Évora;

(2) was part of the universe of electors registered in that polling station, in case it was a traditional polling station;

(3) was not legally barred from voting; and

(4) has not yet exercised his right to vote in any of the electronic polling stations or in his traditional polling station.

This way, in the 232 polling stations of the district of Évora, it was the first time that the system of information of the dematerialised electoral rolls was used, supporting the two voting modalities: the traditional vote and the electronic vote.

1.3 Voting modalities

The Electronic Voting was projected in a way that all the acts and procedures legally foreseen for the traditional voting in paper could be executed, without prejudice to the necessary adaptations.

Therefore, it was strategically decided by the governmental area of the Home Affairs Administration that the two options of voting should be maintained in the Évora district. This decision finds its reasoning in the fact that in question is a Pilot-Project of Electronic Voting and in the understanding that the traditional voting modality should be maintained for the electorate willing to vote in the traditional way.

Consequently, the necessary traditional polling stations were installed in all the voting sections from the Évora district. Alternatively, 47 electronic polling stations were created and distributed according to the following criteria:

(1) the existence of, at least, one polling station in each county of the district;

(2) the coexistence with a traditional polling station; and

(3) ensuring a sufficient number of registered voters that would allow the voters to choose the voting modality through which they would exercise their right to vote, either traditionally or electronically.

1.3.1 Traditional Vote

In line with the rest of the Country, the traditional voting sections in Évora maintained their ordinary procedures unaltered. In the Évora district, the difference was limited to the provision of the CED.

This system has allowed the tellers responsible for the CED to, for instance, search and accept the voters through the reading of the identity card, search by name and to search by the name of the parents, instead of the traditional research, which was done with resort to the voter's number, which was eliminated.

In the 2019 European Elections, the traditional voting in Évora was, therefore, able to count with the inclusion of the CED. This system, used for the first time in Portugal, added to the process a new form of recognition, admission, and discharge of the voter.

In a traditional polling station in Évora, the voting has occurred in accordance with the following steps:

Preliminary operations of the opening of the polling stations

1. The members of the polling stations opened session in the CED.
2. The president or vice-president of the polling station opened it in the CED application.

Voting

3. The voter has walked to the polling station and has identified himself.
4. The voter was recognised when faced with the paper electoral rolls by one of the tellers and when faced with the CED application by another teller.
5. The voter was allowed to vote (in the CED application).
6. The voter has exercised his/her right to vote.
7. Once the exercise of the right to vote was concluded and the ballot paper delivered to the president of the polling station, the tellers proceeded to the discharge of the voter (one teller in paper and the other in the CED application).

Closure

8. In the end of the electoral act and already without voters there, the president or vice-president of the polling station ended the voting process in the Dematerialised Electoral Rolls (CED) and all the members of the polling station logged off the session in the application.

1.3.2 Electronic Vote

As it was described with respect to the traditional polling stations, the electronic polling stations had also access to the CED, with the difference that in this modality of voting, the paper electoral rolls (2 per polling station) were replaced by two laptops to ensure that the two tellers could have access to the CED.

In these voting sections, the traditional cabins were replaced by Electronic Voting cabins and, instead of the traditional ballot paper, the voters found a touch screen with an identical bulletin, but in a digital format (generally called ballot paper, but as the new modality does not involve paper, we'll call it, interchangeably, "bulletin").

After the confirmation of the voting option, by the voter, the system of electronic voting automatically printed a supporting document (a print of the voter's exercise of vote), which was validated by the voter, folded in four and introduced in the ballot box. This supporting document of the voter's intention was kept for possible audits to the system after the elections or in case there are complaints next to the intermediate tabulation assembly of the district of Évora.

In an electronic polling station from the district of Évora, the voting has occurred according to the following steps:

Preliminary operations of the opening of the polling stations:

1. Execution of the opening preliminary operations.
2. Opening of the envelope containing the equipment's access credentials.
3. The president or, in his replacement, the vice-president, has proceeded to the opening of the voting section installed in the voting cabin – inserted the president's or vice-president's card and selected the option "opening of the section" and printed the machine's initial report (to ensure that the machine had not registered any votes by that time).
4. The members of the polling station opened the session in the CED.
5. The president of the polling station opened it in the CED application.

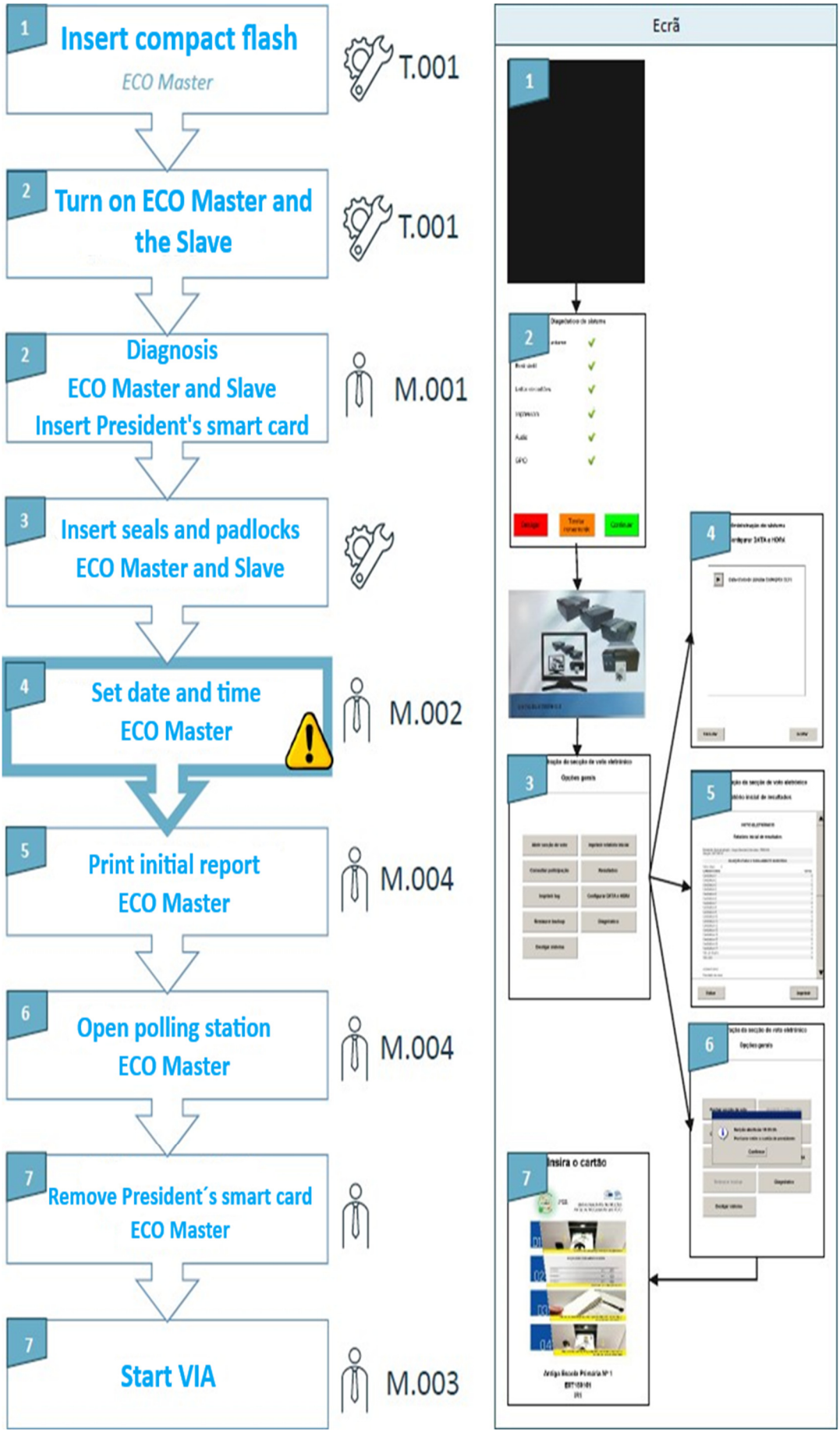


Figure 3 - opening preliminary operations

Voting

1. The voter walked to the polling station and identified himself/herself.
2. The voter exercised his/her right to vote.
3. Once the voter was recognised in the CED, a voting card was attributed to the voter in order for him/her to be able to exercise his/her right to vote only once.
4. Following the exercise of the voting right in the electronic cabin by the voter and the confirmation of his/her voting intention, the vote was registered in the machine and became unaltered. The printing machine printed, in paper, the supporting document, the voter folded it in four, as displayed in the instructions, and delivered, both the supporting document and the voting card, to the president of the polling station. After this step, the two tellers discharged the voter in the CED application.

Figure 4 – Electronic voting steps

Assisted Voting

During the activation of the smartcard by the president of the polling station it was possible for him/her to choose to activate the functionality of the electronic assisted voting. This functionality allowed the citizen with visual disability to interact with the electronic voting system, choosing the option “No” (by pressing the left side of the screen) or the option “Yes” (by pressing the right side of the screen).

These instructions were transmitted to the voter with visual disability through earphones made available by the polling station.

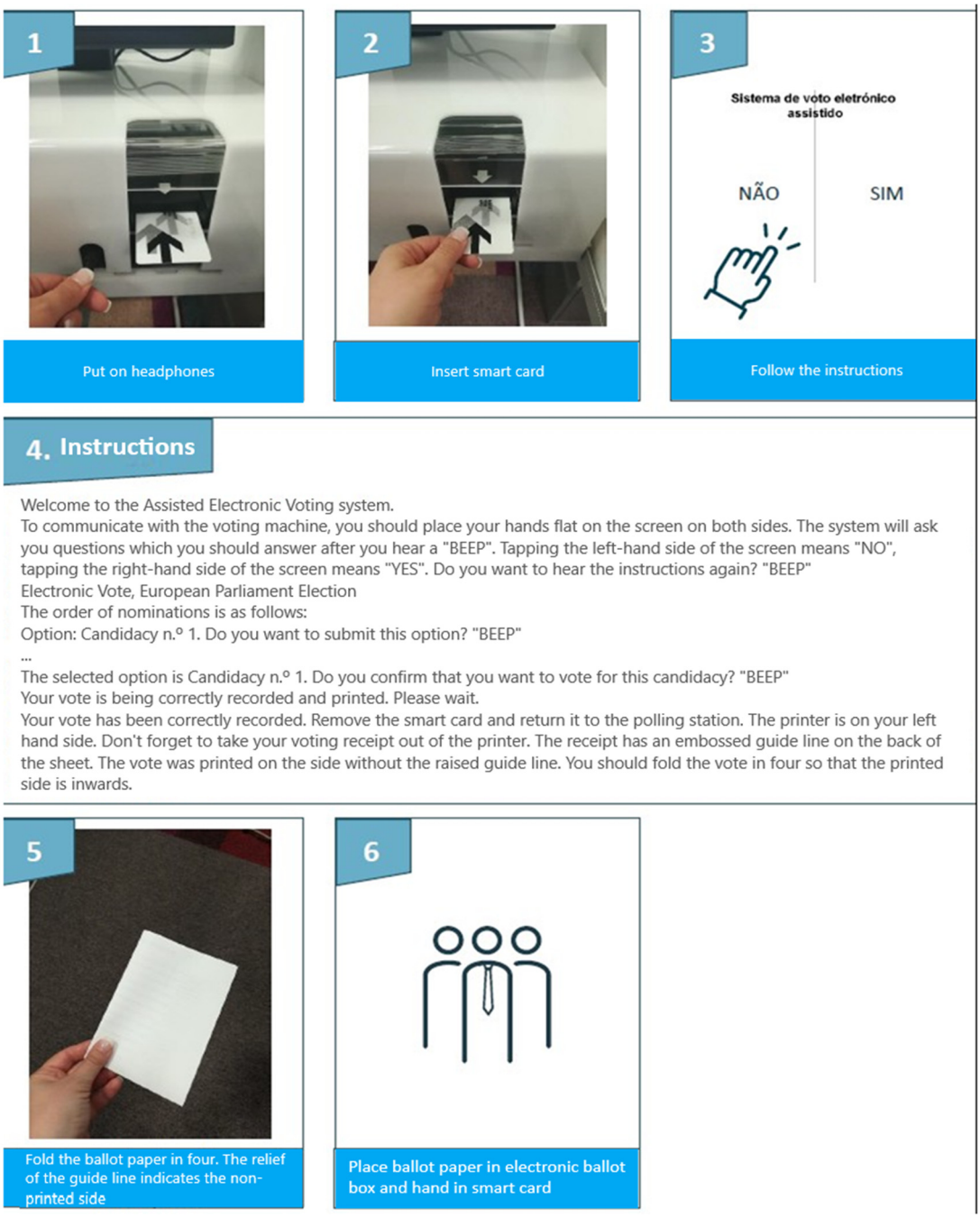


Figure 5 - Steps to be taken to exercise the assisted electronic voting

Closure

In the end of the electoral act and already without voters, the president of the polling station closed the voting process in the CED, and all the members of the polling station logged off the session in the application.

During the closure of the electoral operations, a Report on the Final Results was printed.

Figure 6 - Closure of the electronic voting equipment (less than 100 votes)

Figure 7 - Closure of the electronic voting equipment (more than 100 votes)

In both voting modalities, starting forthwith with the resort to the CED system, the need to adapt the acts and procedures foreseen for the execution by the members of the polling station could be observed, ensuring that the adaptation strictly respected the patterns of the traditional voting.

Therefore, there was the need to adapt the procedures of the polling station regarding the:

(1) opening.

(2) voting.

(3) closure; and

(4) tabulation of results.

1.4 Actions and procedures of the members of the polling stations.

1.4.1 Regarding the opening

TRADITIONAL VOTING	ELECTRONIC VOTING
Preliminary operations • Counting of the ballot bulletins received and of the braille matrices. • Starting of the session in the CED application. • Confirmation of the number of registered voters. • Affixation of the edital containing the names of the members of the polling station and the number of registered voters. • Affixation of the edital containing the lists subjected to suffrage. • Affixation of the expanded ballot paper. • The withdraw of any of the lists implied the communication to the voters through the affixation of an edital. **Beginning of the electoral operations** • After the formation of the polling station, the president declared that the electoral operations had begun, inspected the voting chamber and exhibited the ballot box in front of those present so they could witness that it was empty.	**Preliminary operations** • The president of the polling station turned on the electronic voting equipment, proceeding to the realisation of the self-testing. Initiation of the equipment's configuration and verification of the operability of all the components. Through the president's card, the voting cards activation equipment was switched. • Insertion of the president's card to accede to the electronic voting equipment, to proceed to the configuration of the data and time, to print the initial report and to proceed to the opening of the polling station. • Initiation of the session in the CED application. • Confirmation of the number of registered voters. • Affixation of the edital containing the names of the members of the polling station and the number of the registered voters. • Affixation of the edital containing the lists subjected to suffrage and the expanded ballot bulletin. • The withdraw of any of the lists implied the communication to the voters through the affixation of an edital. **Beginning of the electoral operations** • After the formation of the polling station, the president declared that the electoral operations had begun and exhibited the ballot box which was destinate to gather the supporting documents in front of those present so they could witness that it was empty.

Table 3 – Voting Sections Opening Procedures

1.4.2 Concerning the voting

TRADITIONAL VOTING	ELECTRONIC VOTING
Voting of the members of the polling station, lists' delegates, and early vote: • Voting of the members and the lists' delegates (discharge on the electoral rolls). • In case early votes have been received, the president delivered the blue envelopes to the tellers for them to check if the voter was registered and to proceed to the discharge in the electoral roll. Following this, the president opened the white envelope and introduced the ballot paper in the ballot box without unfolding it. **Voting Mode:** • The voter indicated the name and delivered to the president the identity card. • The president said out loud the name of the voter and the number of civil identification. • It followed the research for the voter in the CED – selecting the option "accept voter". • After the verification of the registration and identified the voter, the president of the polling station gave him back the ballot paper. • The voter entered the voting cabin and there proceeded to the execution of his voting intention. After this, the voter unfolded the ballot paper in four, with the printed side turned to the interior part. • The voter delivered the ballot paper to the president, who has introduced it in the ballot box, the tellers discharged the vote in the discharge column and in the line corresponding to the name of the voter in the paper electoral roll and in the CED.	**Voting of the members of the polling station and delegates of the list:** • Voting of the members of the polling stations and of the delegates of the lists. **Voting Mode:** • The voter indicated the name, delivered the identity card to the president. • The president said out loud the name of the voter and the number of civil identification and introduced the citizen car in the CED, so that the voter could be identified as quickly as possible. • It followed the research of voter in the CED – selecting the option "Accept voter". • After the verification of the registration and once identified the voter, the citizen card of the voter was removed from the CED. • The president inserted the voter's smartcard in the Voting Interface Adaptor (V.I.A.) and proceeded to its activation. Afterwards, selected the "Green" to proceed or the "Red", in case he/she wanted to activate the assisted voting modality, and delivered the smartcard to the voter. • The voter walked to the cabin and initiated his exercise of the right to vote through the insertion of the smartcard in the electronic voting machine. • The voter took out the supporting document and folded it in four, with the printed side turned to the interior part, and removed the smartcard from the electronic voting machine. • The voter walked to the polling station, gave back the smartcard and delivered the supporting document to the president of the polling station, who has introduced it into the ballot box. • The president of the polling station gave back the identity document to the voter. • A teller finalised the voting in the CED, and, subsequently, this operation was confirmed by the other teller.

Table 4 – Voting Procedure of the Voting Sections

1.4.3 Concerning the closure

TRADITIONAL VOTE	ELECTRONIC VOTE
The president of the polling station has declared the end of the voting as soon as all the registered voters had voted or when all the voters present, until seven o'clock, in the voting assembly, had voted.	The president of the polling station has declared the end of the voting when all the voters present, until seven o'clock, in the voting assembly, had voted. • The president of the polling station walked to the electronic voting machine, inserted the smartcard and the authentication password and selected the option "Closure of the voting section" and the option "Confirm".

Table 5 - Closure Procedures of the Voting Sections

1.4.4 Concerning the tabulation

TRADITIONAL VOTE	ELECTRONIC VOTE
• Counting of the ballot papers that were not used and disabled by the voters. • Counting of the voters through the discharges signalled in the electoral rolls, through the visualisation of the "Voting Statistics". • Opening of the ballot box and counting of the ballot papers there inserted. • Publication of the edital with the number of ballot papers inserted in the ballot box. • Counting of the votes in candidacies, of the blank votes and void votes. • Allotment of the votes (bundling by batches of ballot paper corresponding to the voted candidacies, to the blank votes and to the void votes) – Final Conference (Comparison between the number of votes of each lot with the number of registered votes). • Publication of an edital with the ascertained results. • Based on the voting and parcial tabulation operations, the secretary elaborated the minute, which was signed by all the members of the polling station and by the present delegates of the lists. • Communication of the results for the purpose of provisional scrutiny.	• After the closure of the polling station, print by the president of the polling station of the report of the "Results of the Section" and actioning of the functionality "Turn Off the System" of the electronic voting machine. • Counting of the votes in the CED through the visualisation of the "Voting Statistics". • The ballot box containing the supporting documents of the exercise of the right to vote was closed and sealed with a security sticker to be send to the Évora District Command of the Public Security Police. This material was kept under the guard of this Security Force and under the command of the president of the Intermediate Tabulation Assembly. • Publication of the edital with the ascertained results. • Based on the voting and parcial tabulation operations, the secretary elaborated the minute, which was signed by all the members of the polling station and by the present delegates of the lists. • Communication of the results for the purpose of provisional scrutiny.

Table 6 – Tabulation Procedures of the Voting Sections

1.5 Activities and Initiatives

The implementation of the Electronic Vote ensured the proper involvement, preparation, adaptation and operationalisation of the following activities and initiatives:

1. CED – system developed and tailored for the electoral act of the day 26/05/2019.
2. Equipment and system of the Electronic Voting - structured in a way capable of responding to the technical and, primarily, legal specificities of the Portuguese State on the day of the European Elections of 2019.
3. Platform of Provisional Scrutiny (SIAR, Site of Disclosure of Results and *Webservices*) adapted to the European Elections of 2019.
4. Centre of Collection of Electoral Results (CRRE):
   - For the accreditation and training of the Municipal Chambers interlocutors.
   - For the collection of turnouts and results in contingency mode.
5. Line of support to the voter.
6. Three general rehearsals before the electoral act of 26/05/2019
7. Situation Room for the control of all the events on the day of the election.

1.6 Description of the Project

The Electronic Voting emerges in the context of the Elections-Project 2019, which is divided in three big projects:

(1) Elections at national level.

(2) The Dematerialised Electoral Rolls.

(3) The implementation of the pilot project of the on-site Electronic voting, in Évora.

The electronic voting was divided into six stages:

Stage	Period	Description
Stage A	15 january – 27 march	Initiation of the hiring and preparatory tasks until the delivery of the informatic programme and respective equipment of electronic voting for testing
Stage B	19 february – 20 may	Training
Stage C	13 april – 24 may	Simulations
Stage D	24 may – 25 may	Secure cleaning of the data (pre-electoral phase)
Stage E	27 may – 27 may	Inverted logistics (Taken from the electoral material)
Stage F	27 may – 24 june	Final activities of the project, including the final acceptance

Table 7 – Stages of the Project

1.6.1 Timeframe of Activities

In the following timeframe, the main tasks identified are presented, based on the actions foreseen for the Elections-Project 2019, where the electronic voting was included:

Tasks	Starting Date	Closing Date
EUROPEAN ELECTIONS 2019	**01/01/2019**	**26/05/2019**
CED	**01/01/2019**	**11/05/2019**
Systems	01/01/2019	11/05/2019
Electronic Voting in Évora (Traditional Vote and Electronic Vote)	**28/01/2019**	**24/06/2019**
Definition of voting locations	28/01/2019	05/03/2019
Members of the Polling Station (Évora)	15/04/2019	27/05/2019
Training	01/02/2019	25/05/2019
Accreditation	29/03/2019	10/05/2019
Configuration of the Data (Cards, *Passwords* e *Flash's*)	16/04/2019	03/05/2019
Electronic Voting System	14/02/2019	10/05/2019
Communication	08/02/2019	08/05/2019
Training Manuals and Manuals of the Several Systems	27/05/2019	24/06/2019
2019 Election for the European Parliament	**28/12/2018**	**26/06/2019**
Logistics and Technical Documentation	07/02/2019	23/05/2019
Communication Strategy	28/03/2019	29/05/2019
Gateway SMS 3838 – AMA	25/03/2019	29/05/2019
Contact Center	01/04/2019	26/05/2019
Situation Room	09/05/2019	26/05/2019
IT Projects – Information Systems	28/05/2019	26/06/2019
Registration Operations	27/03/2019	23/95/2019

Table 8 – Timeframe of the 2019 European Elections Project

Main dates of the project:

- The 26th of may 2019 – Election Day.
- Conclusion of the CED and Electronic Voting System (including the respective tests) – 11th of may 2019.
- Rehearsals and training in Évora – CED and Electronic Voting:
    - 11th of may 2019;
    - 18th of may 2019;
    - 25th of may 2019.

1.7 Technical Component

This chapter intends to describe the three main technical components that permitted the realisation of the project:

(1) the CED;

(2) the Electronic Voting Equipment; and

(3) communications.

The three components are described below through a brief description and a technical explanation covering the technological component in terms of security and architecture.

1.7.1 CED – Dematerialised Electoral Rolls

The electoral rolls in paper format are the traditional way of verifying who are the citizens entitled to vote in each of the polling stations.

Each electoral roll of each polling station constitutes a list, alphabetically ordered, of the voters entitled to vote in that polling station.

That listing is extracted from the SIGRE system, which maintains the database of the Electoral Registration (BDRE) updated, allowing for the up-to-date extraction of voters in each electoral act.

The electoral roll in paper format presents, however, limitations that could not fail to condition the process designed for the Electronic Voting in Évora, as, on the one hand, it would be necessary to print these lists for all voters in the district, in the Electronic Voting locations, and on the other hand, for each vote it would not be possible to guarantee that the voter had not already voted elsewhere.

In order to overcome these two limitations, the CED system was developed to allow the dematerialisation of the electoral roll in paper format, the simplification of the identification process of voters who are able to vote in the electronic polling stations, to increase the protection of personal data, the privacy of the voter's information and to guarantee the unicity of the vote.

In relation to this last point, in order to guarantee that a voter could only vote once, it was necessary to implement the use of CEDs not only in electronic polling stations, but also in all traditional polling stations in the district of Évora, so as to guarantee that voters could not vote a second time electronically, or vice versa.

The main advantages of CEDs in this process were:

(1) Simplicity and speed in identifying voters in the lists (consulting long lists on paper became a simple search with immediate results).

(2) Guarantee of the confidentiality of voter data, implemented through a procedure that allowed access and presentation of voter information only if the data to be searched permitted an unequivocal identification. This data, once the voting was over, was deleted.

(3) Reliability of the process, with a guarantee of synchronisation of voting in real time between the different polling places, ensuring that the same citizen could never vote more than once during an election (Unicity of the Vote).

(4) Ecological, since with the elimination of the need to print thousands of sheets of paper to create the 47 electoral registers for the Electronic Voting stations in the district of Évora and having reduced the traditional polling station register to one unit, it is no longer necessary to print more than 643,000 sheets of paper (representing more than 3.2 tons of paper).

1.7.1.1 Technological structure

1.7.1.1.1 Architecture of the System/ Implementation Model

The CED system is a system that allows polling station tellers to access information from a centralized database using computer equipment. Both the database and the server software components were housed in the infrastructure of the National Internal Security Network (RNSI), already used for other electoral support systems, thus benefiting from the central infrastructure, as well as all operation, maintenance, and security services, since all components of the CED system were always protected by several layers of physical and logical security, both in terms of infrastructure and in terms of the software itself.

In turn, the accesses made by the tellers to the CED system, at the polling stations, occurred from the equipment made available exclusively for this purpose and configured by RNSI in terms of operating system, installed applications, at the level of active features and available in the

equipment.

These configurations observed the highest security requirements, in accordance with the guidelines of the various teams involved in the process, namely: (i) the development team of the CED system; (ii) the management, operation and administration teams of the RNSI computer park; (iii) the National Unit for Combating Cybercrime and Technological Crime (UNC3T) of the Judiciary Police (Criminal Police); (iv) security and audit teams of the Operational Centre for Information Security (COSI) and (v) the audit team of the University of Minho.

The equipment specially prepared for access to the CED system by the tellers of the traditional and electronic polling stations included laptops with personalized operating system images, with access restrictions related to security, and network equipment also personalized, with controlled and exclusive access to the server infrastructures and to RNSI's central communications equipment.

The customization of the laptops and communication equipment, as well as the specifications of the security requirements were defined by the technical area of SGMAI/TIC, according to the needs indicated by the EDC development team, and the custom operating system image was operationally tested, in terms of security, by the National Unit for Combating Cybercrime and Technological Crime (UNC3T) of the Judiciary Police by the Operational Centre for Information Security (COSI) and by the audit team of the University of Minho.

As a complement to the local infrastructure, installed in each of the polling stations in the district of Évora, as a contingency measure, access to the EDC through the Contact Centre was implemented.

This channel was designed to be used exclusively by polling staff members, in situations of inaccessibility to the system from polling stations, for example due to the temporary failure of computer or communications equipment, network connection failure to the RNSI or power supply failure.

This access could be carried out by a polling station staff member using the credentials assigned to him/her on election day, after automatic validation by an Interactive Voice Response (IVR) system, against the provision of a password and counter password through the calling mobile phone, and subsequent identification of the polling station staff member by the Contact Centre operator.

After automatic validation, the polling station member could be answered by a telephone operator, allowing him/her to interact with the CED system on behalf of the polling station member contacting him/her.

It is important to reinforce that the Contact Centre operator did not have individual capacity to access the CED, but always needed a contact and positive identification from a polling station member, performing on behalf of the latter the actions indicated to him/her over the phone. All operations performed by the operator on behalf of the desk member had to be logged in the CED application and the telephone call recorded.

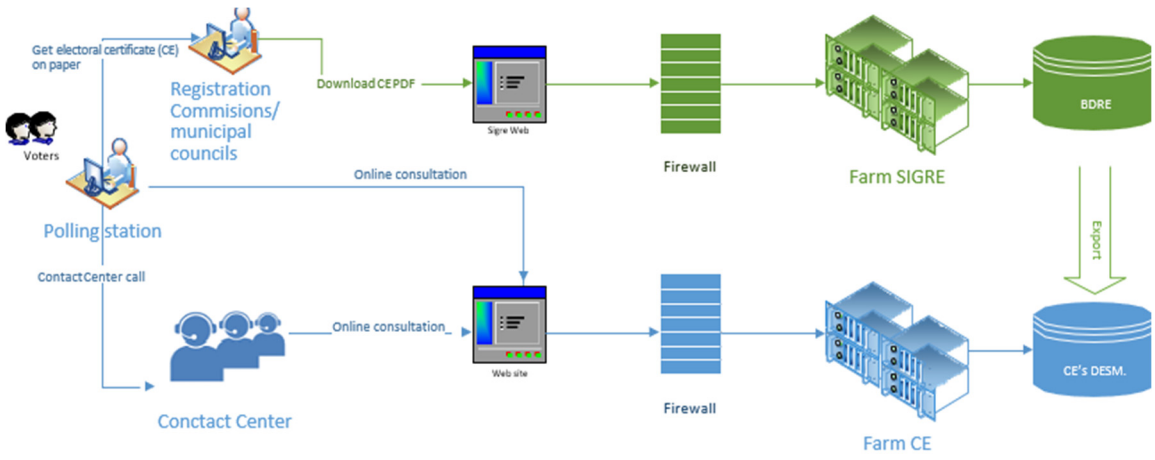


Figure 8 – Architecture of the CED system

1.7.1.1.2 Software Component Architecture

At the software component level, the CED used a Web application with service-oriented architecture (SOA), with a REST type service.

A Single Page Application (SPA) approach was used in the visual component of the CED, in which the visual component of the Web application was downloaded only once in the first access, with subsequent accesses being only relative to the exchange of data with the Web service.

This approach is indicated to guarantee the maximisation of performance and use of the application in environments with reduced bandwidth, considering the limitations identified in some polling places/sections, due to the indoor 3G/4G network coverage, and the construction typology of some buildings used for polling station installation.

Access to the EDC was controlled through authentication with user and password, and the credentials of the polling staff were provided in physical support on the day of the electoral act. All operations of the REST service required authentication, using a token that would be generated at the moment of authentication and would be used in subsequent requests in a transparent manner to the user.

The REST service provided authenticated users with access to controlled functionalities for managing the polling station and the universe of voters registered in it, according to the requirements defined for the system. The actions on these services resulted in persistence of information in a centralised transactional database that ensured synchronisation and coordination of activities between all polling stations.

All CED software components were installed and made available in the infrastructure managed by RNSI, except for a component of access to the citizen card that was installed locally in each of the computers. This component allowed the CED system to access the voter's citizen card to obtain the public data existing in all citizen cards and, in this case, to obtain the photograph and the civil identification number.

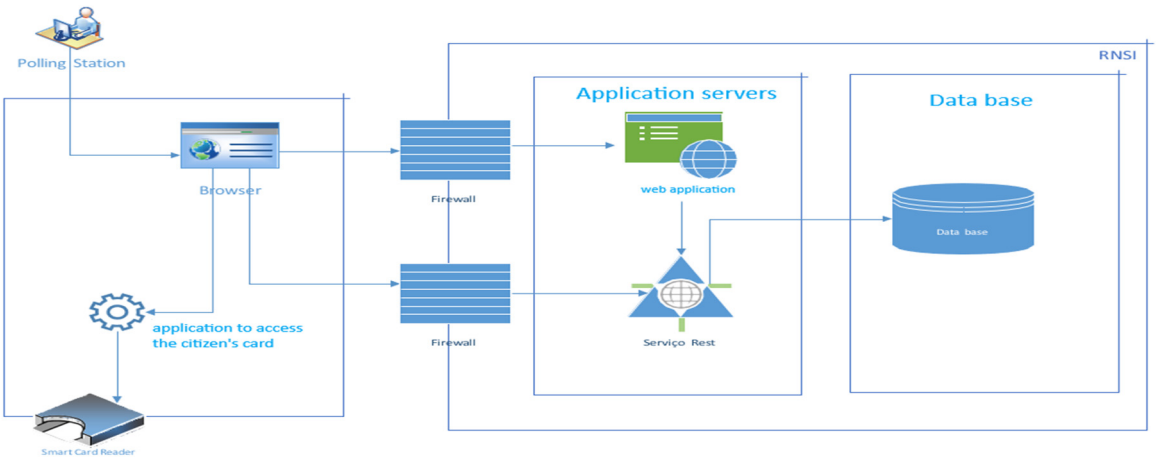


Figure 9 - Software Component Architecture

1.7.1.2 Security

The CED has been developed considering the highest security standards in all aspects of its development, as detailed below.

1.7.1.2.1 Client Laptop Access

Access to the CED at polling stations was done with dedicated computers, delivered in a controlled manner to users for the electoral act. These laptops were configured with customised operating system images, with various security restrictions applied, namely removing the ability to connect storage devices, removing wireless, eliminating access to the BIOS, among others.

Each user used an account without machine administration permissions, with the necessary software components to use the preinstalled and configured CED.

1.7.1.2.2 Access to the CED

The CED was not made available on the Internet, but rather in a controlled manner via the internal RNSI network. The application was made available over an encrypted channel (HTTPS) using TLS 1.2. The laptops that accessed the CED via this channel did not have access to any other network or to the Internet.

The Contact Centre users in the main building (in Lisbon) and in the alternative building (in Alfragide) accessed the CED system through a dedicated and secure access to RNSI.

1.7.1.2.3 Authentication and Authorisation in the CED

Access to the CED system required authentication using a pair of personal credentials (user and password). These credentials were generated and delivered by hand in sealed envelopes to the end users of the system.

Each credential generated made it possible to identify a user with his/her functional profile as a polling station member, the polling station, and the universe of associated voters.

The CED credentials were generated in the application's BackOffice and were stored in encrypted and non-reversible form in the database. A query of the CED database did not allow obtaining the users' credentials. For this reason, for each accreditation report generated with the credentials of the table users, the previous credentials were cancelled. Thus, each credential generated and printed in the report was encrypted and stored in the database irreversibly, making it impossible to generate a new credentials report with the same passwords.

In addition to the authentication control by accreditation with user and password, the CED application logic also implied the strictest rules regarding authorisation, i.e., ensuring that each user only had access to the functionalities of his/her profile and to the set of data allocated to their polling station - for example, the electoral universe of the polling station, in the case of a traditional polling station, and of the district, in the case of an electronic polling station.

1.7.1.2.4 Logging and auditing

All the technological components of the CED application used the highest standards in terms of logging and auditing capabilities. Some of this information was provided by the tools and technologies that support the system, such as Oracle, Windows Server or IIS.

However, the CED system went further and implemented an autonomous logging mechanism with the main goal of auditing user behaviour regarding system functionalities and data. The real-time alert dashboards made it possible to filter this information, giving teams the ability to react in a timely manner to exception scenarios.

Some security alert scenarios implemented in the CEDs allowed for the real-time mitigation of failed authentication attempts, excessively long voting processes, excessive number of simultaneous voting processes in the same place, among others.

1.7.1.2.5 Access to the application infrastructure

Access to the CED software was guaranteed with IIS 10 on Windows Server 2016 servers. Two distinct CED access farms were created from the outset, one to access BackOffice functionalities and the other to provide system functionalities related to polling stations. For each of the usage scenarios, separate encrypted access publications were created.

1.7.1.2.6 Database Access

Access to the database server was restricted to CED application servers. Different Oracle database access users were created corresponding to each of the user profiles, with access guaranteed only to the resources strictly necessary.

For example, for the BackOffice and Front Office CED components, two distinct Oracle access profiles were created, suited to the database needs of each profile.

1.7.1.3 Information privacy

In addition to all the restrictive methods in accessing information in the database, the EDC data model, as well as the system exploitation process, also contemplated methodologies of expurgation of sensitive information that guaranteed that once the electoral act was over, through a simple pre-programmed database operation, it would make possible the definitive elimination of private information of each citizen from the system.

1.7.1.4. Privacy and Personal Data Protection

Electronic Voting was supported by two systems: the in-person electronic voting system and the CED system, restricted to the district of Évora and to citizens registered there.

The first system does not store any personal data of the voter.

The second, the CED system, is regulated and provided for in the Legal Regime of Electoral Registration, established in Law nº 13/99, of 22 March, in its current wording, namely in its article 58, nº 2.

The CED system complied with the principles of Electoral Law:

(1) Officious and compulsory - the universe of voters for the district of Évora was taken from the voter registration database.

(2) Universality - covered all citizens who enjoy electoral capacity in the district of Évora.

(3) Confidentiality - the system ensured the absolute confidentiality of the voting orientation of the voter.

(4) Unicity - the system ensured that each voter only voted once (discharges into the electoral roll exclusively reflected voters who had voted).

(5) Reliability - the system provided reliable results as the counting of voters was done in an automated manner.

(6) Personal nature and on-site character – the system ensured that the suffrage was personal, direct, and physical.

All voting and partial counting operations to be carried out in the Electronic Voting sections by polling station staff reproduced, with the necessary adaptations, the traditional voting procedures foreseen in the legal norms applicable to the European Parliament elections but were processed automatically.

In the polling stations set up in the district of Évora, access to the EDCs was used, which made it possible to:

(1) Verify, by inserting the citizen card or searching by name or identification document number, the location of the voter in the electoral registers. Electronic Voting stations had access to the entire electoral roll for the district of Évora. Traditional polling stations only had access to the electoral roll corresponding to their respective polling station.

(2) Validate that the voter who wished to exercise his/her right to vote in traditional polling stations had not yet done so in any other polling station in the district of Évora, or if it was an electronic polling station, if he/she had not yet done so in the traditional polling station where he/she was registered, or in any other electronic polling station in the district.

(3) Record the exercise of the right to vote in the dematerialised electoral roll by the voters who

exercised their right to vote in that polling station.

The CED information system contained simplified information on registered citizens. This information was extracted through the SIGRE and through the latter from the voter registration database (BDRE). These systems were housed in redundant and duplicated infrastructures in the RNSI's Lisbon and Porto Data Centres, with the same level of protection, security, robustness and audit applied to these two information systems (CED and BDRE).

The CED database was not downloaded locally to the computers installed in the traditional or electronic polling stations, and access was carried out through a set of individual credentials (user and password) which were distributed in person on Election Day in a closed and sealed envelope.

Access to personal data in the CED could be carried out by the System Administrators, for maintenance and administration operations, and by the "Electoral Administrators", i.e. by the polling station members, who by law already have access to this data in the exercise of their functions (through the electoral roll in paper format). The CED system was hosted in the same structure (in separate virtual servers) as the Voter Registration Management Information System (SIGRE).

The laptops installed in the polling stations in the district of Évora are the property of RNSI and were placed in the polling stations on May 25th, having a personalized software image, optimized under the security point of view, having all ports and interfaces disabled.

The equipment was managed by RNSI itself and had no access to the Internet or to any internal network, having access only to the CED information system through its own circuits (VPN and secure https/TLS 1.2 sessions). There was traceability of all the operations undertaken in the system, being the personal data contained in the CED database encrypted.

In the CED information system, after the closure of all polling stations and the generation of the voter reports to be sent to the intermediate tabulation, the table with sensitive voter data was eliminated. The remaining information in the CED was deleted after publication of the official election results by the National Election Commission (CNE) in the *Diário da República*.

The CED system did not access or interconnect with any other information systems and databases managed by the Electoral Administration of the General Secretariat of the Administration for Home Affairs, of other Entities or Bodies of the Ministry for Home Affairs, or of any other External Entity.

And also:

(1) A Code Review of the CED system source code was carried out by the independent team who verified and validated all the source code before it was compiled and put into production.

(2) A series of intrusion and security tests were performed by MAI's Computer Security Incident Response Team (CSIRT-MAI) with the aim of evaluating the behaviour of the systems when subject to loads that may occur fortuitously or maliciously.

(3) The robustness of the hardware and software systems supporting the EDC against malicious attacks was checked in order to determine vulnerabilities and the saturation point of the system, assessing the readiness and reaction capacity of the teams managing it.

The main threats abstractly identified were:

1) the illegitimate access to the data;

2) the unwanted modification of the data; and

3) the vanishing of the data.

The risk assessment associated with each of these threats, carried out by the audit teams, found that the associated risks were insignificant or undefined, given the vulnerabilities identified during the various assessments carried out by the security teams, as well as the prevention and contingency measures implemented.

A Personal Data Impact Assessment was prepared for the "Dematerialised Electoral Rolls" system and submitted to the National Commission for Data Protection (CNPD).

Under Article 38th of the General Data Protection Regulation (GDPR) - Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 - the Data Protection Officer of the General Secretariat of the Ministry for Home Affairs was involved in a timely manner in matters related to the protection of personal data and the respective processing operations, having affirmed its compliance with the GDPR and other applicable legal provisions in the light of Article 39th of the same legal diploma.

In compliance with the provisions of article 13th of the General Data Protection Regulation, regarding the processing of data necessary for the availability of the CEDs, voters were informed through a poster placed near each of the polling stations in the district of Évora, indicating that:

(1) The General Secretariat of the Ministry for Home Affairs was the entity responsible for the data processing.

(2) The purpose of the processing was solely to ensure the exercise of the right to vote of voters registered in the district of Évora and to guarantee the unicity of the vote.

(3) That at the end of the voting and local tabulation operations, after the issuing of the report to be sent to the Intermediate Tabulation Assembly, the data collected would be destroyed.

(4) That the data available in the dematerialized electoral registers was intended solely and exclusively for voting and tabulation operations, with no further processing being carried out.

1.7.1.5 Benefits/ risks

After the first use of the CED system in a real election scenario it was possible to identify a set of situations in which this system worked correctly and according to plan, as well as other situations in which improvements could be implemented, should there be opportunities for a future use of this system.

One of the situations identified as a differentiation factor and of clear added value of the CED system concerns the voter research capacity.

Search times through the CED are very low, with the number of failed searches being practically insignificant compared to successful searches, allowing the perception that the identification of voters by polling station staff, in this system, was indeed very simple and quick.

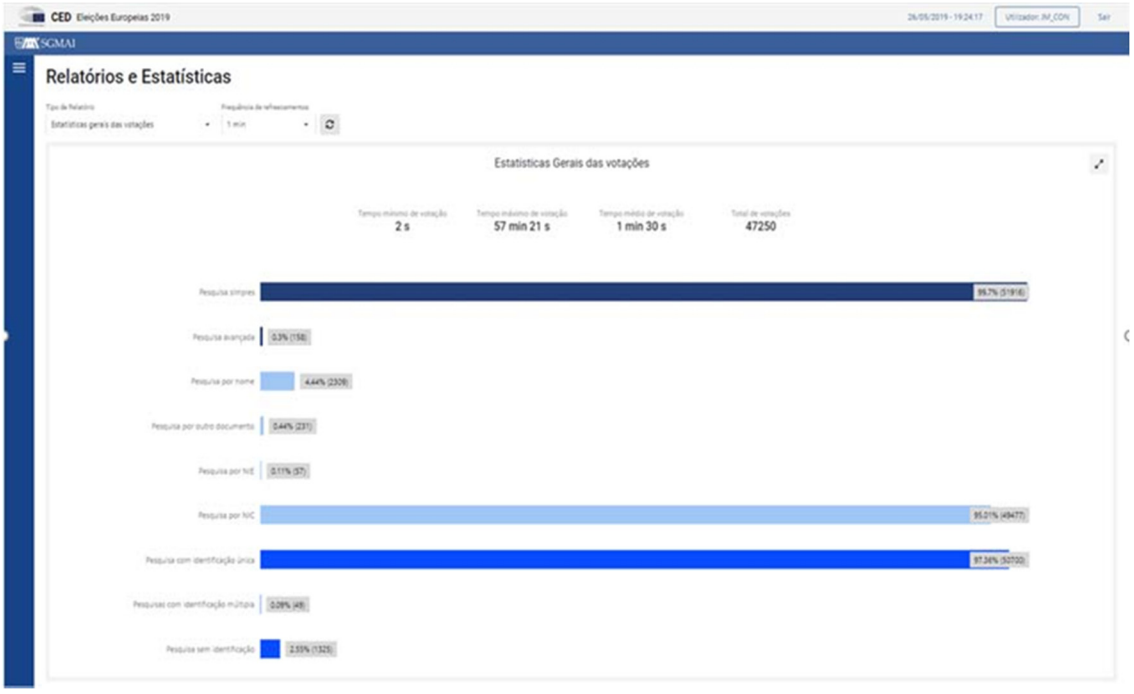


Figure 10 - Report on CED | Held consultations (at 19:30)

On the 26th of May, the preferred search method was the citizen card. Since the electoral rolls in paper format are voluminous and extensive lists, the preferred method that users used was the CED, rather than the traditional method in paper format.

For this reason, and together with the fact that the CED indicates for each voter the page and the line in the corresponding voter register, we believe there is a potential use of this system as a facilitating mechanism to identify voters in the voter register, even in a scenario of non-electronic use (the CED could be used to search a voter by Civil Identification Number, having as output the page/line indication in the corresponding voter register).

Thus, we envisage the CED as a tool to be explored in a future election scenario as a communication platform between polling stations and the electoral control room, allowing the CED system to assist in monitoring and tracking the evolution of the electoral process in the field, follow the evolution of the opening and closing of polling stations, the evolution of voting and the automatic collection of turnouts at 12:00 and 16:00.

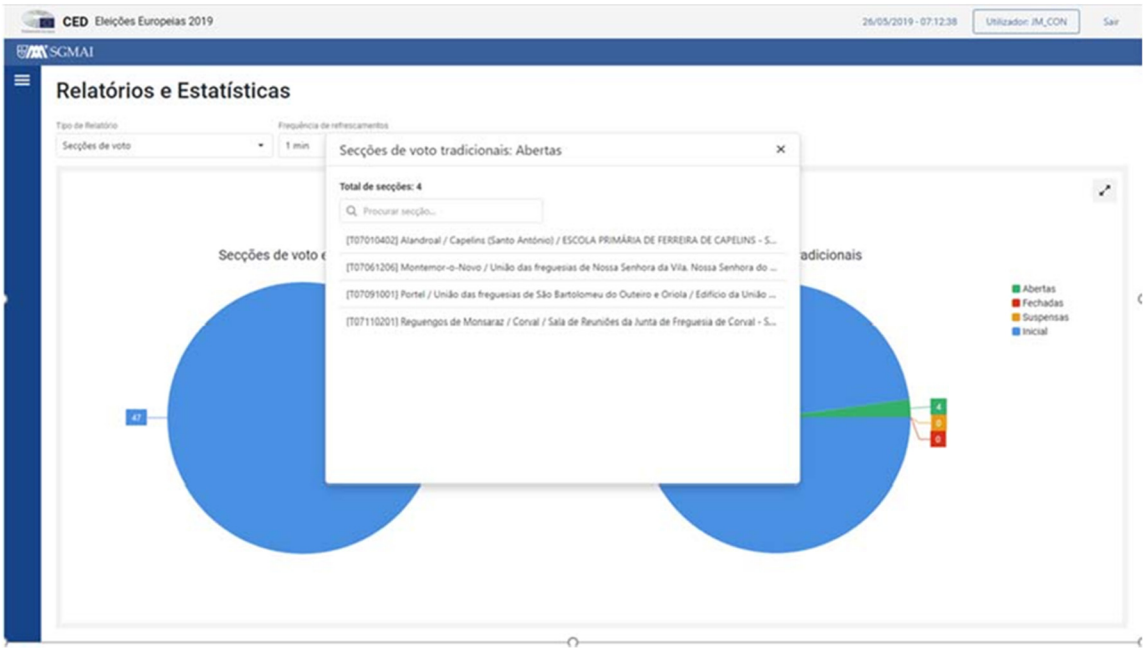


Figure 11 - Open polling stations (07:12)

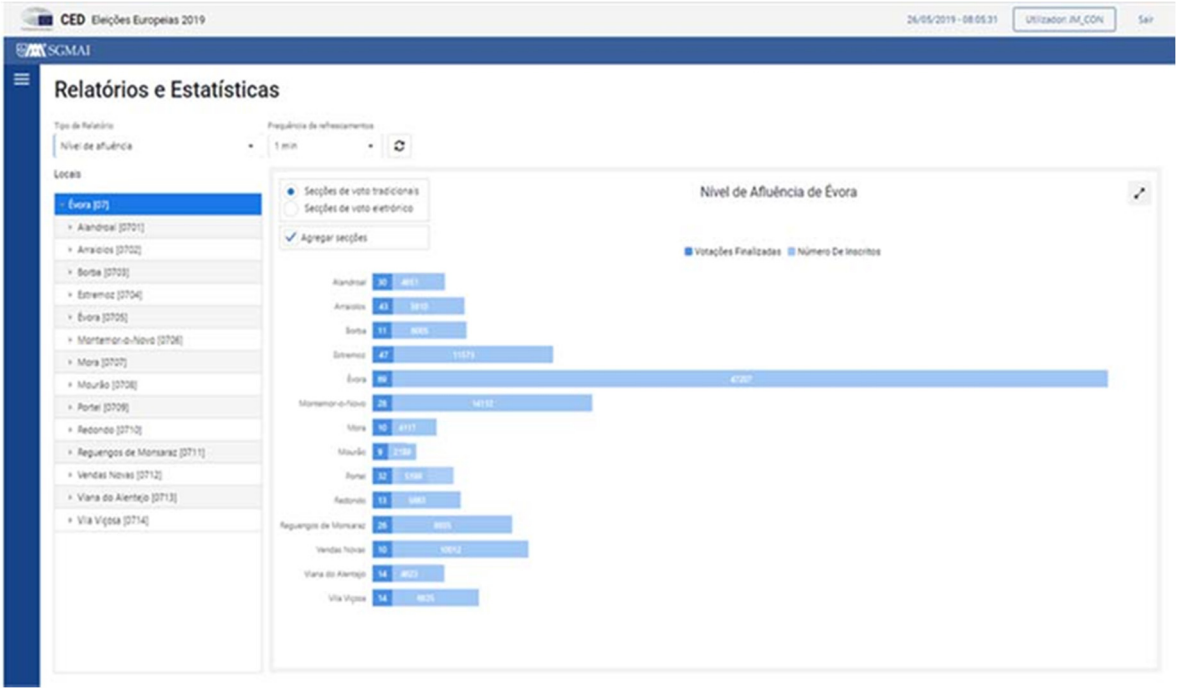


Figure 12 – Electoral turnout (08:05)

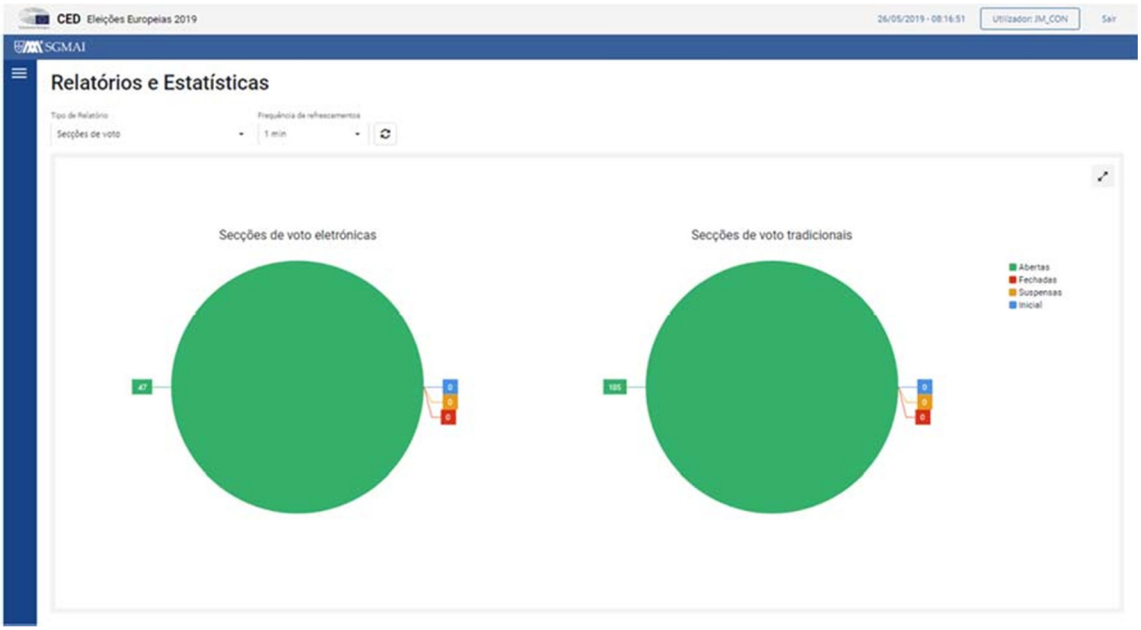


Figure 13 – Polling stations' situation (08:16)

Figure 14 – Production and automatic gathering of polling stations (13:01)

Another clear added value that we verified with the use of the CED system on Election Day concerns the monitoring tools developed for the BackOffice component, namely the dashboards and the functionality to search and consult logs and events. In the case of the dashboards, they were even one of the main support tools for the polling stations, which enabled us to understand and intervene in time in situations of difficulties in authentication.

1.7.2 Electronic Voting Equipment

As it was a pilot Electronic Ballot and because it was essential to ensure its credibility and reliability, the system implemented adopted the Voter-Verifiable Paper Audit Trail (VVPAT) model, issuing a paper ballot receipt (in every way similar to a traditional ballot paper), which was introduced in a ballot box and kept for possible audits of the system after the elections.

The solution adopted for the Electronic Vote, in terms of its usability, security, efficiency and accuracy, is framed by the 2nd generation of electronic voting systems with physical materialisation of the vote.

The second-generation systems record the vote in two independent ways - one in digital format and the other in physical format - paper. The latter is capable of being audited by means which are independent from the voting equipment software. These paper-based Electronic Voting solutions are known as "Independent Voter-Verifiable Record (IVVR)" or "Voter Verifiable Paper Audit Trail (VVPAT)".

1.7.2.1 Technological Structure

The system used in Electronic Voting consisted of a computerised equipment for the direct scrutiny of votes through selection on a touch screen.

The equipment was activated using a voting login token - provided to the system through a Smartcard (SC). The system was completed with the electoral process configuration platform - Election Management System (EMS), which allowed the Electoral Administration to create and configure all the Electronic Voting systems to be installed in the Electronic Voting sections, the respective databases, the Smartcards of the polling station members and the encryption keys used to protect and identify these systems.

It is also important to understand the constitution of the various equipment that makes up the electronic voting system. Therefore, below you will find a list of the various components as well as their description and use:

COMPONENT	DESCRIPTION
P&V ECO	Computer secure both logically and physically where the Electronic Voting application was executed. It contained a card reader (Smartcard Reader) which is the first interface between the user and the application.
Touch Screen	Second interface between the user and the application after opening the session. The voter has made his selection by tapping on the screen.
Printer	Printed the test results of the peripherals (printer, sound system, external disk and screen), the information requested by the voting application, as well as well as the voting receipt.
U.P.S. (*Uninterruptible power supply*)	It guaranteed the operation of the system in the event of an interruption in the electricity supply at the polling station.
V.I.A	Voting interface adapter, card reader that cleaned the Smartcard (voting cards), allowing their reuse.
Smartcards (voting cards)	Cards used to open sessions in the electronic voting application.

Headsets	The headsets were used by those who needed audio access to the voting process, namely blind voters.
Electronic voting cabin	Booth designed to ensure the confidentiality of the vote. Complied with accessibility requirements.

Audio Lock	Audio connector blocker: connector of connection to the audio access interface for connection locking.	
Compact Flash	*Compact Flash (CF) memory card: Physical support for the specific data of each polling station.*	

Table 9 – Components of the Electronic Voting Equipment

1.7.2.2 Description of the Electoral Process

The Electronic Voting process was designed to correspond with maximum rigour to the traditional voting system, both in terms of the procedures to be carried out by the polling staff and by the voter. As a mere example, the initial report printed by the electronic voting machine is the electronic confirmation of the process of checking that the ballot box is empty. The entire remaining process - presented below - followed the same rules of transparency that exist in the traditional voting process.

1.7.2.2.1 Initialising the Electronic Voting Equipment

The system was initialised with its memory card (CF). At system start-up, an electronic check of all components was performed to ensure proper operation. After the system was initialised, it became available for the electoral act, allowing voting to begin. The guarantee that no votes had been cast prior to the opening of the Electronic Voting table was done by printing the initial report. To print this report, it was necessary for the presiding officer to insert his presiding officer Smartcard into the P&V ECO and enter the presiding officer PIN to start the administration session.

1.7.2.2.2 Voting

After the polls opened, the system was ready for the voter to vote. The voter received a Smartcard from the presiding officer of the polling station, which activated his/her voting session, after which the voter selected his/her voting option by touching the touch screen.

After confirming the vote and it being correctly registered, the system printed a digital ballot paper, identical in all respects to the paper ballot paper, which was inserted in the ballot box.

Once the voting session was over, the voter would not be able to reopen it with the same card and should therefore return it to the polling station.

The system also allowed for assisted voting through the use of headphones which indicated to the voter, by means of voice instructions, the steps they should follow in order to vote.

In order for the Smartcards to be reused, the electoral authority, using the V.I.A. equipment, had to activate a previously used Smartcard after receiving it.

1.7.2.2.3 Closure of the Electronic Voting Equipment

At the end of the election, the presiding officer proceeded in a similar manner to close the section and compile the results.

1.7.2.2.4 Voting results report

The results report had two formats, depending on whether the total number of votes at each polling station was greater than 100 or not, which in fact occurred. If the number of voters was less than 100, to ensure the principle of confidentiality, the system did not provide the results, but allowed for the printing of a report showing the total number of votes and a key that should go with the respective memory card (FC) to the aggregation desk.

1.7.2.3 Security

The Electronic Voting system was designed with security as the main requirement, and the system should be robust by combining both physical and electronic security aspects.

The main security aspects are described below:

i) ***Point & Vote*** **ECO (P&V ECO):** this computer equipment ran the voting application and had all its components contained in a compact box with resistant materials that withstand strong impacts, high temperatures and humidity. The electronic components were screwed to metal plates which not only protected it from sudden movements, but also helped to dissipate heat and prevent possible overheating. The cables connecting its peripherals were made of resistant and compact materials arranged in such a way that no accidental disconnection could occur.

ii) **Blocked access:** the P&V ECO unit was closed and locked using a Kensington-type lock which does not allow access to the on/off switch, nor access to the doors or external data storage unit.

iii) **Monitoring System through Leds:** The P&V ECO unit had three large LEDs of different colours to enable the electoral authority to monitor the progress of the voting process.

Figure 15 - LED system

iv) **Acoustic Alerts:** If an attempt was made to open the locked door or remove the cover, the P&V ECO unit had opening detectors that emitted an acoustic warning signal advising the electoral authority of intended unauthorised access.

v) **Access to audio output:** the audio output was only accessible when a voter asked the polling station for assisted voting. Otherwise, the audio output was locked with its own lock which prevented the introduction of external elements. Only the presiding officer had the key to unlock the output, which was used to connect the polling station headphones.

vi) **Protection against electric fluctuations:** the system had its main electronic components connected to the electric current through a U.P.S. to avoid an

interruption of the operation and protection against a voltage spike preventing equipment breakdown.

vii) **Guaranteeing the functioning of the computer and its peripherals:** at first the computer performed a set of self-diagnostic tests that checked the operation of both the computer, the external storage unit and all peripherals. At the end of the self-diagnosis a compliance report was printed.

viii) **Protected *Smartcards* (SC):** The Electronic Voting equipment had a Smartcard reading interface which was open to any user. In this way, both the voting application and the V.I.A. application had a series of encodings which ensured that sessions could only be initiated with the introduction of valid cards associated to them. The Smartcard memory structure was divided into three areas, each of which was protected with a distinct PIN in order to avoid data manipulation.

ix) **Restricted access to the system:** the president of the polling station could only access the restricted areas of the system by introducing the correspondent Smartcard and PIN code, which was of his/her exclusive knowledge, therefore avoiding an undesirable access in case the Smartcard was introduced by a non-authorised person. The Smartcard blocked at the third attempt (of an invalid PIN).

x) ***PIN Codes*:** In order to access the system, print reports and open/close the polling station, the presiding officer had to enter the respective PIN code. These three codes were automatically generated in the electoral configuration platform (EMS) and were specific for each polling station and respective electronic voting equipment. The PIN codes for the test days were different from the codes used on election day.

xi) **Restricted access to the database:** the database of the voting application could only be opened through a specific cipher key. This cipher key was specific knowledge of the Electoral Administration and could only be used to access the database by entities that were authorised by law.

xii) **Encryption of the data:** the voting application read the boot-up data from an encrypted file that only the application could read. Reading and decryption of the data outside the system was only possible by an entity empowered by law.

xiii) **Ciphering data from the database:** the following data were encrypted with the introduction of a specific password entered by MAI in the Electoral Management System (EMS):

(1). *PIN Code*;

(2). Votes per candidacy;

(3). Name of the parties;

(4). Party abbreviation.

xiv) **Report certification code:** At the top of the reports there was a unique code. This code was the result of the combination of the ECO machine serial number, date and time of printing, and subsequent encryption with the same level as the database encryption.

xv) **Voting *Smartcard*:** The Smartcard that initiated a voting session did not contain any voter information. This was one of the reasons that the cards could be reused.

xvi) **Procedures for recovering backups:** the system allowed to continue from the step prior to the appearance of a flaw, through a process for recovering backups;

xvii) **Replacement of the components:** in case there is a flaw in any of the components, these could be replaced by the authorised technicians and at the request of the president of the polling station.

xviii) **Initiation of the voting session:** The application flow was defined in such a way that only after all the procedures involved in the vote registration had been successfully

carried out, the Smartcard was changed, thus making its reuse unfeasible.

As an additional security measure, there was a counting system designed to avoid that cloned Smartcards could be used.

1.7.2.4 Analysis of the Execution of Electronic Voting

The implementation of Electronic Voting provided a digital environment similar to the real environment of traditional voting but controlled in order to test technological innovations. Electronic Voting systems are a vehicle for learning and identifying technical and operational challenges, as well as opportunities for improvement, in addition to allowing for the evaluation of what is being tested, and acceptance by the population.

In relation to participation and adherence to Electronic Voting, the voting statistics made it possible to determine that of the total participation in Évora, 33.29% of voters voted in electronic polling stations. However, 74.6% of the polling stations were traditional polling stations compared to 25.4% for the electronic polling stations. This means that in relative terms the electronic polling stations had on average 97% more voters than the traditional polling station

	Traditional voting	Electronic voting
Polling Stations in Évora - total	185	47
% Polling stations over the total (232)	74,6%	25,4%
Average of voters by polling station	170	335

Table 10 - Comparison of the average of voters by voting section

Municipalities	Registered	Voters traditional vote (VT)	Voters Electronic vote (VE)	% VT	% VE	% Adherence VE
1. Alandroal	4 641	1 087	399	23%	9%	37%
2. Arraiolos	5 909	1 903	691	32%	12%	36%
3. Borba	5 999	1 095	970	18%	16%	89%
4. Estremoz	11 560	2 778	745	24%	6%	27%
5. Évora	47 130	10 398	6134	22%	13%	59%
6.Montemor-o-Novo	14 100	4 507	1481	32%	11%	33%
7.Mora	4 108	1 087	431	26%	10%	40%
8.Mourão	2 183	300	316	14%	14%	105%
9.Portel	5 191	1 385	451	27%	9%	33%
10. Redondo	5 642	1 004	591	18%	10%	59%
11.Reguengos	8 925	1 673	724	19%	8%	43%
12. Vendas Novas	9 998	2 219	1295	22%	13%	58%
13. Viana do Alentejo	4 614	859	633	19%	14%	74%
14. Vila Viçosa	6 823	1 219	875	18%	13%	72%
Total	**136 823**	**31 514**	**15 736**			55%
% Vote	**100%**	**23%**	**12%**			

Table 11 – Distribution of voters by County

By analysing the previous table, we can see that in the municipality of Mourão, the number of voters who voted electronically was higher (by 16 voters) than those who voted traditionally, and in Borba, Mourão, Viana do Alentejo and Vila Viçosa, more than 70% adhered to the

electronic voting method by the voters who cast their votes there.

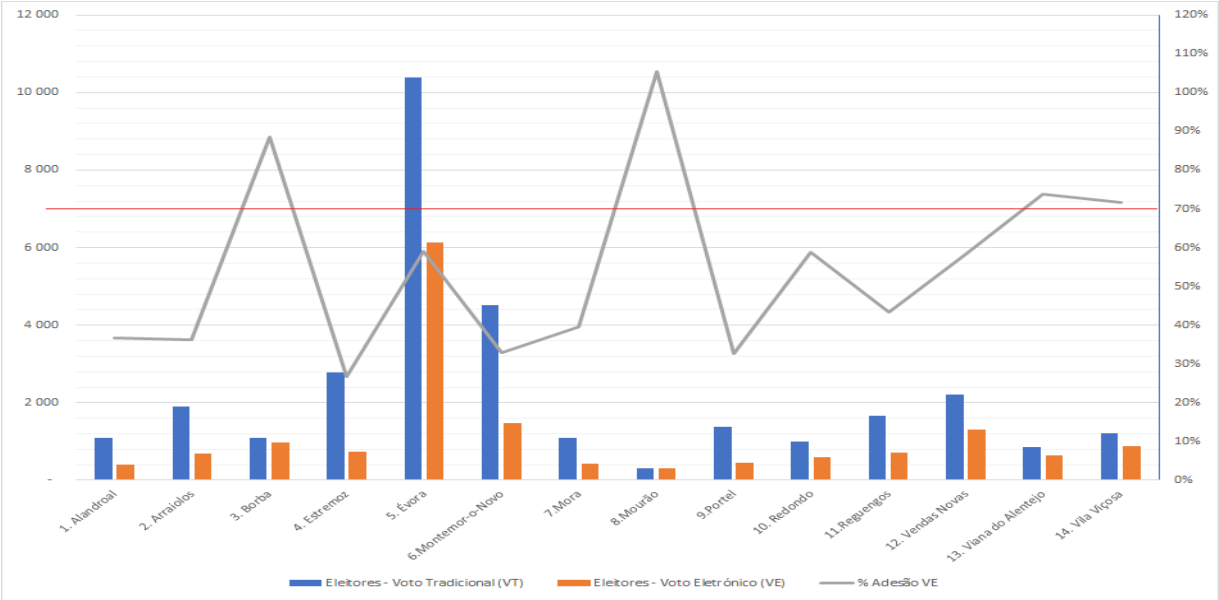


Figure 16 - Distribution of voters by count

The factors that contributed to this positive acceptance by citizens will have been:

(a) The transparency with which the whole process was managed:

- Good management of the public communication;
- The risks of cybersecurity were eliminated since there was no transmission or integration with any communication network. The electronic voting equipment was offline, without any connection;
- Security Audits;
- Process Audits;

(b) The maintenance of the audit registration (supporting document)

The decision to print a “paper ballot paper” at the moment the vote is cast on the electronic voting equipment was a fundamental requirement in the design of the Electronic Voting system. The “paper ballot paper” made it possible to provide each voter with the ability to validate their voting intention, thus increasing confidence in the system for three reasons:

1) On the one hand, the voter could check that his vote on the screen corresponded to his “paper ballot paper”;
2) On the other hand, in the event of a complaint, it would be possible to compare the number and intentions recorded on the “paper ballot papers” stored in the ballot box and the electronic votes recorded on the electronic voting equipment;
3) The simplicity of the voting process.

During the project's development, special importance was given to simplifying both the voting procedure and the remaining procedures on Election Day which are the responsibility of polling station staff (opening, closing and printing the results). Regarding the voting procedure, the use of Smartcards to access the electronic voting equipment had no relevant incidence.

The opening and closing procedures of the polling station showed no relevant incidences during Election Day.

This indicates that the training was adequate, taking into consideration the effort made during project development to simplify all processes on Election Day.

1.7.2.5 Technical Support

On Election Day, 26 May, around 56 technicians were involved, distributed among the 47 Electronic Voting sections and the management teams installed in Évora (CIMAC) and in Lisbon (TagusPark) for the exclusive support of the Electronic Voting sections equipment and respective polling station members.

The technicians accompanied the polling members in the different electoral procedures, providing technical support when requested by the presiding officers, such as the replacement of paper in the printers or the prompt response to the resolution of incidents that arose with the equipment.

All polling stations opened and closed without technical problems.

The level of incidents during Election Day was minimal and all incidents that arose were resolved quickly.

The 27 incidents reported to the Helpdesk during Election Day were logged:

(a) Printer incidents (67%) Paper Replacement (17): Each Electronic Voting section had 1,000 sheets for printing the voting supporting document. Thus, during the day, the technicians monitored the need for paper supply and the eventual need for reinforcement by the Electoral Administration. There were several sections that were autonomous in terms of paper replenishment.

(b) Incidents V.I.A (15%): in all cases the device was rebooted, and the incident was resolved. Average resolution time was 4 minutes 25 seconds.

(c) Incidents with voting machines (11%)

   a. Slow machine (1): the machine is replaced with a backup machine. ECO replacement. Change of card importing information. Card replaced (had 35 votes from the Electronic Voting machine that were confirmed in the CED). Resolution time of the incidence was 9 minutes.

   b. Electronic voting machine switched off (1): it was restarted. Resolution time of the incidence was 9 minutes.

   c. Monitor with failures in its tuning (1): the equipment was calibrated. Resolution time of the incidence was 9 minutes.

(d) Other incidents (7%)

   a. Headset malfunction (1): One of these pieces of equipment needed to be replaced. There were backup headsets on all tables. Resolution time for the incidence was 9 minutes.

One voter kept with the Smartcard (1): it turned out that the number of votes in the Electronic Voting machine was the same as in the CED.

1.7.2.6 Audits

During the project, together with the National Unit for the Fight against Cybercrime and Technological Crime (UNC3T) of the Judiciary Police, with the Operational Centre for Information Security (COSI) of MAI and with the University of Minho, actions were developed to mitigate project risks, including security risks, in order to create a contingency plan adapted to the specific needs and characteristics of a project of this nature.

In summary, the main characteristics of physical and logical security of the system are described below:

(a) Physical Security

- Robust system with resistant materials which supported strong impacts, high temperatures and humidity.

- Access door blocked.
- Monitoring system through lights.
- Acoustic alerts.
- Protection against electric fluctuations through a U.P.S. (*Uninterruptible power supply*).
- Access to system wiring locked by padlock.
- Access to audio input blocked.

(b) Logical Security

- *Hardening* of the Operative system and configuration LAN.
- Restricted access to the system (both from the voting application and the V.I.A. application) for the administrator functions through Smartcard and PIN (data encryption).
- Backup recovery procedures: the system allowed to continue at the point before the appearance of a fault, through a restoration process.
- Single voting session per voter, controlled through Smartcard, which prevented duplicate voting.

The system did not store any information relating to the voter, thus complying with the provisions of data protection legislation (Article 32 EU Regulation 679/2016 GDPR).

1.7.3 Communications

The services provided in the electronic communications component for the support of Electronic Voting in Évora were the following:

(1) Provision of a dedicated communications infrastructure, in all the locations where polling stations operated in the district of Évora, in order to guarantee a secure and segregated connection between them and the RNSI data centres (located in Taguspark and Contumil).

(2) Preparation, installation, monitoring, operation, technical support and maintenance services for the communications network, communications equipment and IT equipment, supplied by SGMAI, at all locations. The supply of electrical and data cabling, necessary for connecting the various equipment operating in the various polling stations, was also ensured.

(3) IT security services for the entire communications solution.

(4) Provision of a management portal and various dashboards, centralised, to control the operation of the services in operation for all locations.

The data communication solution was supported in a dedicated private network environment VPN.IP/MPLS and included the supply of routers for the RNSI Data Centres (TagusPark and Contumil). For the 232 polling stations in the district of Évora, the services of preparation, installation, support, collection, and replacement of 430 routers and 400 laptops were ensured.

The management, support and monitoring services and other services that ensured the availability of the entire solution were also activated, as well as the gauging and demonstration of the Service Levels of the components that make up the entire solution.

1.7.3.1 Technological Structure

The VPN.IP/MPLS access solution for the two RNSI Data Centres was made up of redundant connections (interface, path and POP) in a total of 4 (four) circuits, with a minimum speed for each connectivity of 200 Mbps, Full-duplex, synchronous and without contention.

The connections of the two RNSI Data Centres were configured in load sharing mode in order to maximise capacity and availability.

The following figure represents the architecture of the implemented solution.

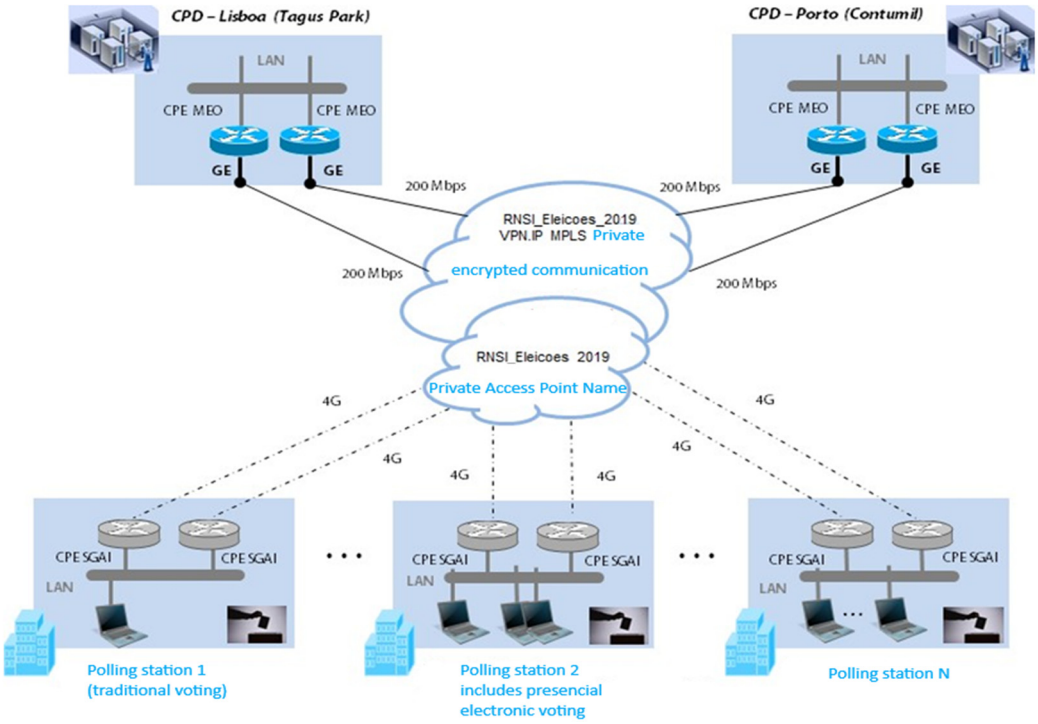


Figure 17 - Communication Structure

For the connection of polling stations, a private APN (Access Point Name) was created to ensure secure and private access to communications.

For some locations where the 3G/4G coverage inside the polling station was below the optimal level, External Antennas were used in order to increase the network level. In situations where, even with the use of these external antennas, the network level outside was still below the optimal level, physical fibre circuits were installed, or in copper when the fibre solution was not available.

1.7.3.2 Security

The communications network was provided in a dedicated private network environment that guaranteed the security and privacy of each polling station's data in the interconnection with the two RNSI Data Centres.

All communications between polling stations and the two RNSI Data Centres were carried out in a private environment and encrypted at the network level using IPSec, ESP/AES256 and AH/SHA2.

All the consortium's network security and supervision mechanisms were reinforced during the four main periods (3 days of tests and Election Day).

1.8 Logistics

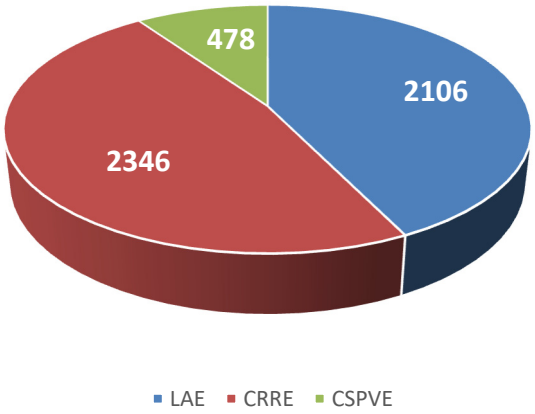
To guarantee logistics throughout the district of Évora, an operation was implemented that optimised the routes so that in the event of any interventions, they could be carried out in less than 30 minutes - the defined service level. It should be noted that the technical know-how required to operate the resources, given the various specialities involved (energy, telecommunications, transmission, and IT), required a rigorous selection of resources to ensure the success of the project. About 210 technicians and 140 vehicles were allocated to the project in the logistics area.

1.9 Contact Center

The Contact Center service was a fundamental part of the Electronic Voting and integrated the entire project, ensuring:

- Support services in the context of the trials performed.
- Support services for the European Parliament Elections (CSPVE).

Throughout the Contact Centre's operating period, from April the 2nd to May the 26th, on the 3 support lines set up, 4 840 calls were received, distributed as follows:



LAE – Voter Helpline

CRRE - Electoral Results Collection Centre Helpline

CSPVE - Electronic Voting Pilot Helpline

Table 12 - Distribution of calls by support line

The CSPVE line went live on the first day of the Electronic Voting trial, which took place on 11 May, and will remain open throughout the remaining working days to allow extra support and tests to be carried out beyond the days set for this purpose.

2 Execution

The execution of the work initiatives during the design, implementation and operation periods of Electronic Voting enabled the identification of a series of activities that were subject to a refined management and control, in order to be reflected in the defined stages and activities, in order to ensure that they had a high level of quality and achieved the proposed goals.

A structured governance model was drawn up to monitor all the fronts of Electronic Voting:

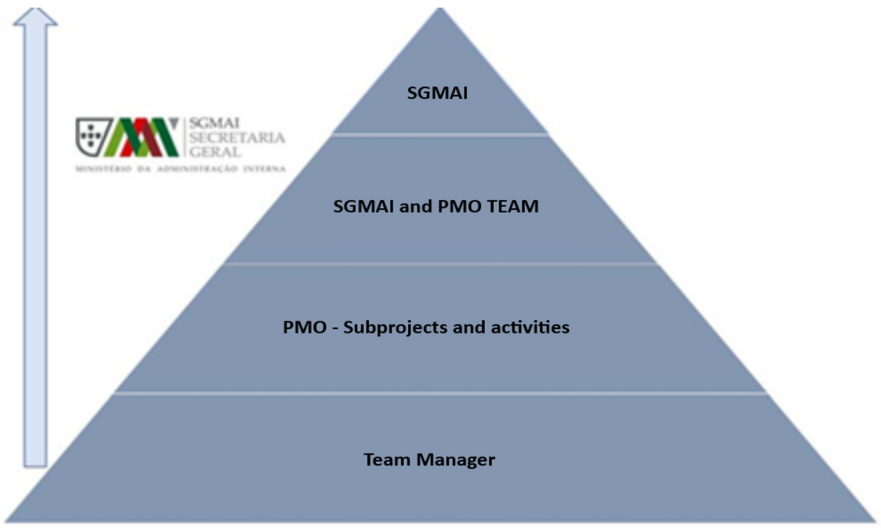


Figure 18 - Coordination Structure

2.1 Organisation

The Electronic Voting involved internal teams from SGMAI, external contractors, the University of Minho, AMA (Agency for Administrative Modernisation, I.P.), Judiciary Police, Public Security Police, as well as the Republican National Guard.

Project management was performed according to collaborative management standards (ISO 44001) with an alignment between work teams and a shared risk management.

All the supplies and work teams demonstrated a great capacity for joint work and alignment of objectives, these elements being the key to the success of the project.

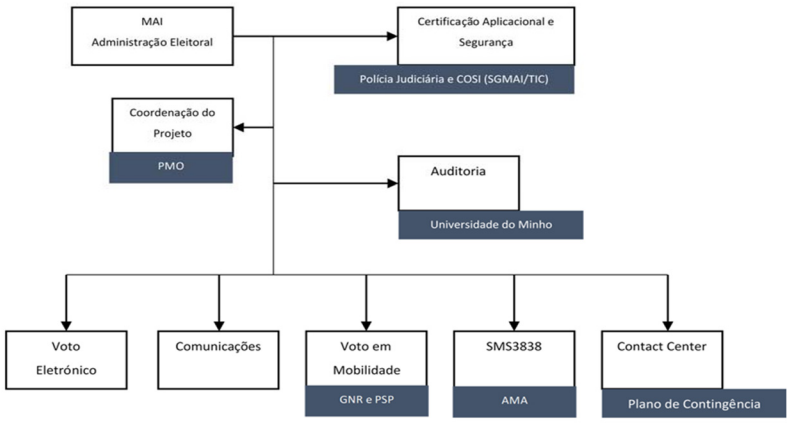


Figure 19 – Project Organisation Chart

2.2 Framework

For a better framing of the work and the activities and tasks performed, a table was developed with the set of activities and routines followed during the Electronic Voting period. It should be noted that the information displayed here (Table - Activities Plan) is grouped according to the frequencies proposed and aligned in the initial stages of the work.

Activity	Detail	Attendance
Technical and internal meetings (SGMAI)	Meetings to align the needs and execution of the activities defined by team.	When necessary, but at least once a week.
Global meetings	Meetings to align all the teams involved in the project.	Every two weeks
Meetings with focal points in Évora	Meetings to align and define the training plan and the trials in the district.	When necessary, once a month
Activities of technical and functional development	Activities to execute the planned work, by team. (SGMAI)	Daily

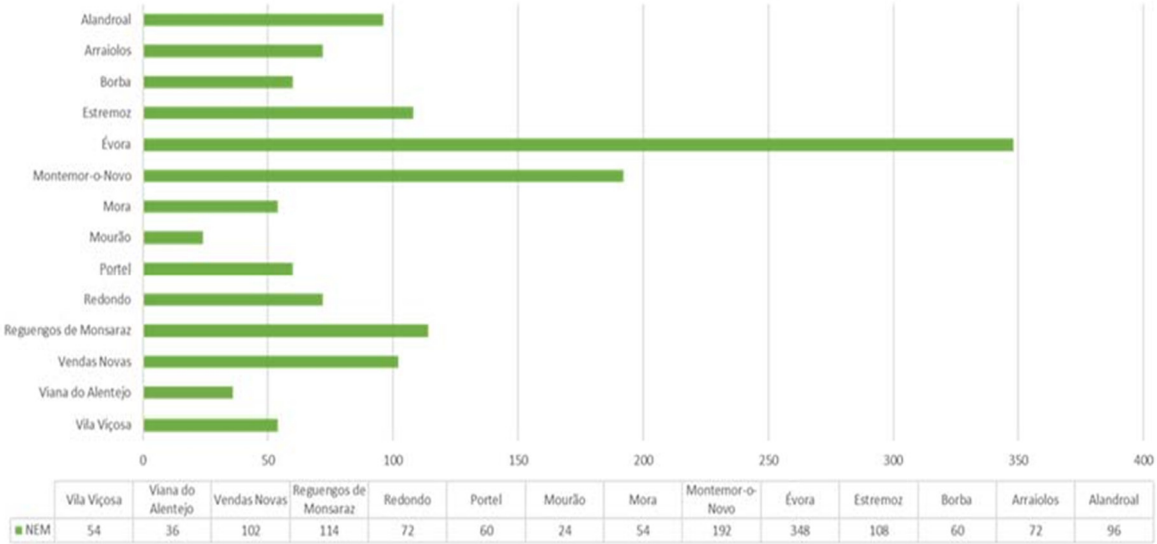
Table 13 - Activities Plan

2.3 Training and trials

The general objectives of the training sessions were to provide trainees with the necessary skills to adequately perform their duties as polling station presiding officers, in traditional and electronic polling stations.

The training was intended for all 1,500 polling station officials in the district of Évora who were in office on election day, including candidates' agents and employees of the Parish Councils and Municipal Councils.

Figure 20 – Distribution of training places and groups by County



	Vila Viçosa	Viana do Alentejo	Vendas Novas	Reguengos de Monsaraz	Redondo	Portel	Mourão	Mora	Montemor-o-Novo	Évora	Estremoz	Borba	Arraiolos	Alandroal
NEM	54	36	102	114	72	60	24	54	192	348	108	60	72	96

Figure 21 – Distribution of learners (polling station members) by County

This initiative was integrated in the rehearsals, that is, in the days of tests and simulations that took place during three weeks on 11/05, 18/05 and 25/05 (Saturdays).

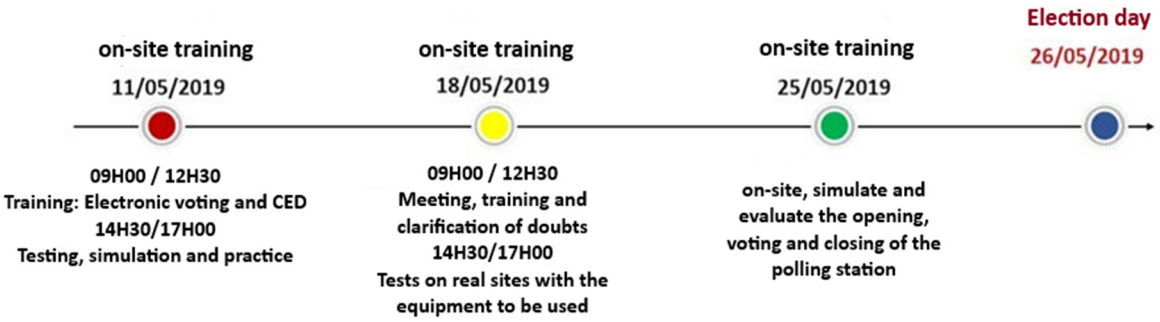


Figure 22 – Training Calendar

The training program was divided between a practical and a theoretical component, thus allowing all table members to learn in a more complete manner the various parameters necessary for the handling of the equipment on Election Day.

On 18/05, between 15:30 and 17:00, tests and simulations were carried out to ensure that all polling staff rehearsed and tested all the procedures they would be performing on Election Day. On 5/18, the test session was open to the public, and the general population was invited to test the electronic voting equipment and simulate its use.

Training Plan		
11th May	**18th May**	**25th May**
Morning • Legislative changes. • Electronic Voting Framework. • Impacts on the voting process in Évora. • End-to-end processes. • Introduction to the CED. • Query handling. • Visualisation of Practical Cases (CED).	Morning • Legislative changes. • Electronic Voting Framework. • Impacts on the voting process in Évora. • End-to-end processes. • Introduction to the CED. • Query handling. • Visualisation of Practical Cases (CED).	Morning • Performance of tests/simulations on Election Day. • Simulation of the main risks and correspondent mitigation actions.
Afternoon • Practical tests to the equipment. • Execution of the several processes of electronic voting. • Simulation. • Analysis of practical cases and correspondent mitigation actions.	Afternoon • Performance of tests with simulation of the Election Day. • Opening to the local population for them to get to know/how to use the electronic voting equipment.	Afternoon Nothing to refer

Table 14 - Training Plan

2.3.1 Specific Aims

In terms of specific competencies, the intention was that by the end of the training sessions, the learners were able to:

- Know the legislative changes that came into force in 2018.
- Distinguish the different phases of the electoral act.
- Distinguish the procedures exclusive of the electronic sections.
- Identify the procedures of each of the phases of the electoral act.
- Carry out the procedures that are the responsibility of their function.
- Guide the voter in the electronic voting process.
- Identify anomalous situations in the dematerialised electoral roll and in the electronic voting system.
- Fill in the minutes of the polling station.
- Identify the documents to be annexed to the minutes.

2.3.2 Programmatic Structure

Theoretical Module	Practical Module

• Framework:
  ○ Legislative changes 2018.
• Typology of the sections.
• Comparison matrix between the traditional and the electronic vote.
• Step-by-step analysis:
  ○ Traditional vote.
  ○ Electronic vote.
• Equipment listing.
• *Setup* of electronic voting equipment.
• Access profiles.
• Counting of the votes.
• Exceptions and Contingency Plan.
	• Practical exercises
	  ○ Electronic Voting practical exercises.
	  ○ CED practical exercises.

Table 15 - Training Plan

2.3.3 Training Methodology

The methodology used in the theoretical module was the expositive and interrogative method. In the practical module the technique applied was demonstration, role play and simulation of the electoral act.

2.3.4 Modalities and ways of training organisation

- Modality: Initial training.
- Organisation format: alternance.
- On-site training.
- Training in labour context (respective voting section).

2.3.5 Monitoring and Evaluation Methodologies

The monitoring system during training intended to verify:

1. The conformity in the execution and progressive fulfilment of the pedagogical objectives.
2. The respect for planification and respective programmatic structure defined for the course.
3. The adequacy of the training methodologies to the needs and expectations of the learners.
4. The adequacy of the equipment and pedagogical resources to the execution conditions of the training.
5. The fulfilment of the established timeframe and the assiduity of the learners.
6. The adherence, reactions, and level of satisfaction of the initial expectations of the learners and trainer in relation to the training activity.

In the context of the evaluation, the following dimensions of analysis were considered:

1. evaluation of the performance of the trainer; and
2. evaluation of the training.

2.3.6 Audio-visual and Pedagogical resources

1. Audio-visual resources:
    - Laptop.
    - Multimedia projector and screen.
2. Pedagogical Resources:
    - Support presentation.
    - CED and electronic voting practical guides.
    - Guide of procedures.

Support documentation was provided to trainees in the first session - made available on the online platform a week before the beginning of the training, in order to allow a more rigorous follow-up on the issues addressed, as well as their subsequent consultation.

2.3.7 Training material

The training material was prepared by MAI and distributed to the trainers and/or Municipal Chambers. The documentation was also made available by the PAVE.

- Support presentation.
- CED and electronic voting practical guides.
- Guide of Procedures – Extensive guide elaborated by the Electoral Administration to serve as support during the election day.

2.4 European Parliament Election Day – 26/05/2019

For Election Day in Évora, a different routine than usual for the whole country was structured. Some supervision activities took place on a minute-by-minute basis, as the CED application, as previously mentioned, allowed for greater control for each polling station in the district.

Any anomaly occurring in CED (login failure, suspension) in a polling station was monitored by the teams installed in CIMAC – Intermunicipal Community of Alentejo Central - and in Lisbon (Taguspark). Every 60 minutes a report with the movement of information and activities of the

systems involved in the elections was delivered by each team to the group responsible for managing the project. Thus, due to this control routine, it was possible to monitor the performance of the entities and take corrective decisions in a timely manner.

The schedule of activities taking place on 26/05/2019 is presented below:

Schedule	Activity	Detail
07:00	Preparation of the equipment (CED and electronic vote) and of the voting sections.	Due to the Electronic Voting, this timetable was determined to ensure the proper functioning of the equipment before the beginning of the voting process.
08:00	Start of the electoral voting process.	N/A
19:00	End of the electoral voting process.	N/A
Subsequent hours	Parcial tabulation of the results	After the end of the voting, parcial tabulation operations, the disclosure of results and the filling of the respective minutes took place.

Table 16 - Activities Timeframe - day 26/05/2019

3 Analysis, acquired knowledge and recommendations

This chapter will verify the results obtained in the Electronic Voting versus the intended results, analysing all the aspects addressed so far (technological components, processes, training and testing, logistics, among others). The main benefits resulting from the development of this project are also verified, as well as the risks and respective mitigation actions. Finally, the knowledge acquired based on the points previously addressed.

3.1 Obtained results *versus* intended results

The subsequent table was elaborated in order to confront the obtained results and the intended results. Therefore, there can be an efficient analysis of all the compared topics and formulate a plausible conclusion.

Obtained Results	Intended Results	Conclusions
• Significant acceptance by the population when faced with the new modality of voting (electronic vote).	• Acceptance by the population when faced with the new modality of voting (electronic vote).	• Very positive acceptance by the population, very promising for future electoral acts.
• Security and reliability of results obtained on election day	• Insurance of the security and reliability of results obtained on election day	• Security and reliability of the results obtained on election day
• Significant interaction between all the intervenient and services from the Municipal Chambers with an elevated focus on electronic voting	• Positive interaction between all the intervenient and services from the Municipal Chambers with an elevated focus on electronic voting	• Interaction between the electronic voting teams as a whole was positive and recognised by all the parties involved
• Guaranteed and well executed training for installing the equipment and sending the necessary data/documents for the project	• Efficient and effective training for installing the equipment and sending the necessary data/documents for the project	• Great effort dedicated to the training component and associated logistics. Ensured the success and the overcoming of challenges perceived during the rehearsal and election day phases.

Table 17 - Obtained results vs. Intended results – Conclusions

3.2 Main benefits and risks identified

In this part of the document, the main benefits and risks identified during the electronic voting implementation phase will be identified.

Main Benefits	Identified risks	Obtained results
• The CED allowed the voter to exercise his right to vote in mobility	• Polling station members are the main parties responsible for the electoral and therefore learning the necessary operations for electronic voting is fundamental	• Once the risk was identified, an additional effort was made regarding training. Therefore, the training was successfully completed, allowing the polling station members to perform all the necessary operations without difficulty
• Intermediate tabulation at the end of the voting through the electronic voting equipment	• Possible failure in the tabulation and transmission of final data in the framework of provisional scrutiny	• The passage of data was consistent and ensured by all entities involved. Positive outcome
• Modernisation of the electoral process	• Acceptance by the population and political powers	• Solid acceptance by the population and political powers
• Security and reliability of the information/votes	• Possible security failures and invasion by third parties of the database systems of the European Elections	• Stability of the system and security of the information, data and voting electronic equipment were currently executed. Positive result

Table 18 - Benefits, risks and conclusions

3.3 Acquired Knowledge during the process

The objectives of Electronic Voting were fully met and the electoral act took place normally and without any serious incident or disturbance in the systems/platforms.

The good performance was due to the set of processes, infrastructures, applications, people and coordination, which led to an adequate response and excellent cooperation among all the entities involved, to whom we acknowledge all the availability and support demonstrated.

The results of the analyses carried out in a structured manner, the knowledge acquired, the positive points and the aspects to be improved are as follows:

Focus of the analysis	Positive Aspects	Acquired Knowledge
Implementation of the Electronic Voting Pilot	From the outset, the existing needs at various levels for its implementation were identified, which allowed a thorough and systematic monitoring of the project.	Capacity for detailed planning of technical and functional requirements. Scaling of the effort required to carry out the tasks Point to be improved: articulation between the appointment of the board members and the training actions
Deadlines and implementation	Close cooperation and coordination between the teams and entities involved in the process.	Adapting management capacity and resources to the legally prescribed implementation deadlines Points to be improved: - Need to extend the structure of the electoral administration. - Need to authorise multi-annual budgetary commitments.
Management of the process	Carried out in a thorough and direct manner. Proximity between all teams involved.	Ability to plan and coordinate projects of high-level technological complexity with multiple teams simultaneously working on the project. Aspect to be improved: Optimising the organisation of the contents and logistics plan
Information systems	Good performance allowing its permanent control. Possibility to reuse in future electoral acts.	Capacity to use the already existing applicational infrastructures and of interoperability between systems
Model of internal communication	Direct and assertive between the teams	Aspect to be improved: Develop a single platform for internal communications
Teams	Articulation between the several teams, allowing the fulfilment of the defined goals	Aspect to be improved: Rethink its format and optimise its functions and responsibilities

Communication networks	The Electronic Voting solution worked out well, even in places with reduced mobile coverage	Aspect to be improved: Strengthening of the mobile communication networks

Table 19 – Positive aspects and features to be improved

3.4 Recommendations

The recommendations are based on the analysis of the topics structured according to the following manner:

Topic	Analyse	Recommendation
Operational functioning of the information systems	Executed as planned, without any impact anomalies identified	Maintain the system
Processes and procedures	Carried out in a manner appropriate to the implementation of Electronic Voting, although limited by the legal constraints in force in force	Enabling full use of technological capabilities
Technological structure/architecture of the Electronic Voting booths and equipment	Able to exercise Electronic Voting including suitability for persons with visually impaired or illiterate	Improving the system to make it more inclusive
Technological Structure of the Dematerialised Electoral Rolls (CED).	The technological structure of the EDCs was an essential pillar of the project, to whose success contributed decisively the robustness of the security systems of MAI and those resulting from the contributions of the Judiciary Police	Progressive use in future elections, including early voting and voting abroad
Logistics used during the Project	The logistical process designed for election day and the trial days was able to guarantee the success of the operations, but with additional effort additional effort by the teams involved	Adequacy of human resources to the logistical needs identified in the implementation of the project
Results of the survey to the Focal Points of the district of Évora.	For most respondents, the project had a high success rate and should be repeated in the next elections in the district of Évora and, if possible, throughout the country	_____

Table 20 – Conclusions and General Recommendations

3.4.1 Phasing of the electronic Voting at national level

The Electoral Administration bases its credibility on three pillars: the integrity, efficiency and transparency of the electoral process. Implementing electronic voting nationwide will require strengthening the capacity of the Electoral Administration of the General Secretariat of Home Affairs to successfully execute electoral processes in a transparent, efficient, and sustainable manner, providing the technology to ensure the integrity of processes and data.

This section aims to analyse the challenges of a project of this scale in maintaining and improving the excellent levels of quality and transparency of the electoral administration in Portugal.

3.4.2 Strategic Vision

From our point of view, the designed and developed concept of Electronic Voting has demonstrated that it is fully valid, complies with the constitutional principles of our electoral law and is applicable to any type of election in Portugal.

The concept of the Electronic Voting system is based on:

(1) Mobile voting that allows the voter to vote at any polling station.

(2) The printing of the paper version of the Electronic Voting voucher, which allows for a 100% audit of the process.

(3) Option of electronic or traditional voting, both available at all polling stations. This gives a choice to the voter, who can opt for the one he/she feels most comfortable with.

(4) Total decoupling of voter identification and the voting system, which guarantees the secret vote as a fundamental right.

(5) Solution based on commercial components, which allows for continuous technological evolution without changing the main concept of the solution and optimising costs, besides simplifying component recycling.

(6) Solution designed to meet usability and accessibility requirements.

The implementation of the Electronic Voting system throughout the country, which will require the respective legislative changes, will offer the following benefits:

- Accessible and available voting in all polling stations, thus being aligned with compliance with the United Nations Convention on the Rights of Persons with Disabilities (Portugal is one of the 162 countries which adhered to this United Nations Convention).
- It facilitates voter mobility and will therefore be an important factor in encouraging participation.
- It allows the other modalities for exercising the right to vote to be maintained (traditional voting and, as far as foreigners are concerned, postal voting).
- Applied to early voting, it will simplify the process, since the ballot paper can be automatically personalised for each type of election, depending on the elector's constituency.
- The system is intuitive to use, making it easier for voters to cast their vote, including voters who do not use information and communication technologies in their daily lives.

To design the phasing of implementation at national level, two lines of work are proposed:

1. **Implementation of a Strategic Plan**. The plan should be designed to implement the recommendations identified in the first part of this report, introduce additional technological developments and new services, in a gradual manner and synchronized with the electoral calendar until national coverage is achieved.

   Thus, the phased approach will allow for testing of Electronic Voting in all types of elections, significantly reducing the associated risks prior to its nationwide implementation.

The phasing in stages also allows for:

(1) Build the confidence of the voter and other stakeholders as the plan progresses.

(2) To develop skills within the electoral organisation (MAI) for the management of Electronic Voting.

(3) To adapt to future technological developments that will be available in the near future.

(4) Design a multi-annual investment plan.

2. **Implementation of a Communication Plan.** The Strategic Plan should include a communication plan based on two pillars:

   i) **Internal Communication** directed at all the organisations involved in the electoral project. In this way, close cooperation between the main project stakeholders will be promoted and their contributions to the development of the strategy can be included to ensure its success.

   ii) **Public Communication** throughout the electoral cycle. Dissemination and communication activities during the life of the project will contribute to the principle of electoral transparency and will be decisive in building confidence in the electronic voting system. The public communication strategy could incorporate additional measures aimed at increasing awareness and citizen participation in the electoral process based on the use of technology.

Thus, implementation at the national level has major implications for project organization since coordination with local authorities is a key part of the electoral process. It will therefore be necessary to have a minimum project structure in each of the 22 constituencies to coordinate logistical and support tasks in each of them.

4 Main conclusions

In the light of what is set out in this report, it is possible to conclude:

- **Dematerialised Electoral Rolls (CED):**
  - It´s implementation in all polling stations in the district of Évora allowed voters in this constituency to exercise their right to vote in mobility in any of the 47 electronic polling stations or in the traditional polling station where they were registered;
  - Ensured the unicity of the vote;
  - This system allows for greater voter protection insofar as the eVoting station only knows which voters are there to vote and is completely unaware of the situation regarding the remaining voters in the district; on the contrary, the traditional polling station has permanent access to the list of voters who have already voted and of those who have not voted in that polling station;
  - Through this technology it was possible to have a real time perception of the global panorama of the district of Évora in terms of turnout, the number of voters (with no nominal identification) and the state of polling stations;
  - The CED was very well accepted by the polling staff, given its ease of use and the speed and security of voter identification;
  - With the use of CED it was possible to avoid printing 643,000 sheets of A4 paper (3.2 tonnes).

- **Electronic Voting:**
  - The Electronic Voting equipment (totally autonomous from the EDCs) ensured the confidentiality of the vote as it was not possible at any time to identify the voter exercising the right to vote;

- The system also allowed the voter, through the printing of the voting voucher, to validate how he had voted;
- Likewise, the voting receipt allows for the auditing of its conformity with the result expressed electronically;
- The election results expressed in the ballot box proved to be authentic, thus providing assurance of the reliability of the system;
- The system enabled polling staff to obtain the tabulation of the election results immediately after voting closed;
- The Electronic Voting equipment is designed for use by visually and mobility impaired voters;
- The average number of voters per polling station was double the average number of voters in traditional polling stations;
- The ease of use of the Electronic Voting equipment was the quality most referred to in the survey of Évora's board members and Focal Points.

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