Case Study Report on Electronic Voting in the Netherlands

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BACKGROUND

Electronic voting has a long history in the Netherlands. In the 1960s, the Secretary of the Electoral Council was fascinated by the mechanical voting machines used in the United States, and convinced the Ministry of Interior (MoI) to allow for their use. On November 25, 1965, a new version of the Electoral Law was implemented that regulated the use of voting machines by the local authority in pre-assigned polling stations.

The MoI and Kingdom Relations (MOIKR)[48] is responsible for the overall framework of elections in the Netherlands, including developing the legislation. At the same time, the Netherlands has a decentralized system and the municipalities (currently over 400) have the responsibility for conduct of elections. Accordingly, while the ministry was responsible for ensuring proper regulation of voting machines, it was at the municipal level that decisions were made on adopting new technology. The Electoral Council also serves as an advisory body to the ministry on election-related issues and conducts vote tabulation in national elections.

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48 The name of the ministry used to be "Interior" only; in 1998 "Kingdom Relations" was added.

Thirteen local authorities introduced American mechanical voting machines for provincial elections in March 1966. This did not go well, as there were an abnormal number of blank votes due to the fact that machines were introduced hastily and voters were not made aware of the change.

Subsequently, the Dutch decided to design their own voting machines, and the Minister of Interior requested an Order in Council on rules for the approval of voting machines in 1968. It asked the Dutch Organization for Applied Scientific Research (*Toegepast Natuurwetenschappelijk Onderzoek,* TNO) together with Samson Kantoor Efficiency to develop a design for an electronic voting machine. The Dutch Apparatus Factory (*Nederlandse Apparaten Fabriek* NV, NEDAP) was asked to build a machine based on this design. A few years later, NEDAP began not only producing the voting machines, but also designing and developing them. By the end of the 1980s, 1,200 voting machines were in use in 60 local authorities.

This initial development of the machines set a precedent; TNO and NEDAP were in control of the situation regarding voting machines and made most decisions regarding their development. Neither the Electoral Council nor the MoI set any requirements for them.

In the late 1980s, the first electronic voting machines appeared, and by the mid-1990s their use in Dutch elections was widespread. The machines appealed to local authorities, as they were seen to reduce mistakes in the process, decreased the number of staff needed for the vote count and made the release of results much quicker. There was no public or political debate regarding the early introduction of mechanical or electronic voting machines, and they appeared to be popular with voters. The only concern raised was whether elderly voters might be discouraged from voting as a result of the adoption of technology.

LEGAL FRAMEWORK

From the early introduction of voting machines in the Netherlands, their regulation in law remained limited. In 1989, the Electoral Code was revised thoroughly; however, there were still few references to electronic voting. The code explicitly stated local authorities could decide if voting means other than ballot papers are used, that this was only allowed with technical appliances approved by the MoI, and other rules would be determined in the Electoral Decree, although they were never elaborated.

One paragraph of the code (Article J33, Paragraph 2) listed requirements for the "approved technical appliance," including: secrecy of the vote needed to be guaranteed; the appliance had to be well-made; the voter had to be able to operate it easily; the candidate lists, their assigned number and the name of the political groups needed to be mentioned clearly; and the voter only had the possibility to vote once and had the opportunity to correct a mistake.

Later in 1989, the State Secretary produced a Ministerial Regulation for the Approval of Voting Machines, but the document was process-oriented and did not include any additional requirements or standards for voting machines. The MoI and the Electoral Council lacked technical knowledge to determine clear requirements regarding functionality, integrality and security of the voting machines.

By 1990, the Electoral Council and the MoI realized the regulation of voting machines was not adequate. For the next seven years a working group was convened to discuss new regulation requirements and approval of voting machines. The working group consisted of members of the MoI, the Electoral Council, TNO, representatives of local authorities and the Expertise Centre, which included HEC, a consultancy agency dealing with public administration/ICT issues. The MoI and the Electoral Council depended heavily on TNO and HEC for their technical knowledge.

TNO drafted a final concept of the technical text of the new regulation in September 1990, including requirements for the software to be reliable, clearly written and not changed or influenced. However, while voting machines informally had to comply with the TNO report from its date of publication, it was not until 1997 that the regulation was approved. It still did not require any security features or address the possibility of manipulation. No requirement for a paper trail was included, as the State Secretary explained, "one can assume that the print out of a voting machine with the voting results is the same as the votes that were cast on the voting machine, so that afterwards there is no need to check the votes cast."[49]

During the working group's deliberations, a lengthy discussion opened about the possibility of phased voting – a possible solution for increasing the number of political parties and candidates per party in elections. The Minister sent a letter to Parliament in March 1996 granting permission for the option. NEDAP stood alone in its opposition to phased voting, as its machines at the time did not have the capacity to process votes in this way. This opened the possibility for other suppliers, and was the starting point for the company VUGA (later SDU) to start developing voting computers. However, NEDAP remained the primary supplier, with 95 percent of the market.

CERTIFICATION

In 1997, the Regulation on Requirements and Approval of Voting Machines came into force, which dealt with approval of the use of voting machines by the MoI. The supplier first needed to receive the approval of the Minister on a prototype of the voting machine. Approval was granted on the basis of a statement from an acknowledged certification office, which checked whether the prototype met the requirements as set out in the Electoral Code, the Electoral

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49 Staatsblad 1997, pgs. 164and297, Besluit tot wijziging van de bepalingen van het Kiesbesluit inzake stemmen door middel van elektronische stemmachines (Decision to amend the regulation on voting by electronic voting machines).

Decree and the appendix to the 1997 regulation. The Minister did not officially receive any certification reports, and they were not publicly available.

To receive approval to actually use the voting machines, the supplier provided the certification office with 10 voting machines (of which the certification office chose one), so it could be determined whether the voting machines resembled the prototype and the conditions under which it was tested. The decision to approve a voting machine was to be published in the *State Gazette*. The supplier was then required to make available, at least once every four years, 10 voting machines, out of which the certification office would choose one, so it could be examined periodically.

The required technical specifications were detailed in an appendix to the regulation. The accreditation office was required to check whether, based on a list from the supplier, the software had been installed in the machines and whether the software did what it was supposed to do. However, NEDAP had successfully lobbied to exclude the part of the software that was used to program the political party lists and the candidates on the voting machine from the certification process. The source code used for all voting machines and computers was closed software owned by the suppliers. No review by other external actors was allowed. Due to these restrictions, it is unclear if a comprehensive check of the complete source code of all software was ever conducted by the certification office.

Not all of the requirements laid down in the Electoral Code, such as secrecy of the vote or readability of the screen, were elaborated in the regulation. Rules regarding storage, transport and security of the voting machines were also lacking. One month after the regulation came into force, TNO (now called *TNO Centrum voor Evaluatie van Instrumentatie en Beveiligingstechniek*), which assisted in the drafting of the Regulation, was appointed by the minister as the only certification office.

Following the regulation's adoption, different ministers conducted research into the possibilities of recounts and certification, due to minor errors in tabulation software and some limited discussions about these two issues in the media. However, no changes were made until the State Secretary Bijleveld-Schouten withdrew the Regulation on Requirements and Approval Voting Machines in February 2008.

The MoI was responsible for the proper conduct of the election process, and the directorate of Constitutional Affairs and Legislation was responsible for overseeing the regulation of voting machines throughout their development. However, these civil servants, whose expertise was in constitutional and electoral law, lacked the knowledge to deal with the technological aspects of the voting machines. No additional personnel with technical background were recruited. As a result, the suppliers played a large role in deciding which equipment was used, how legislation was written and which parts of the electoral process was part of the certification process.

CONCERNS ABOUT ELECTRONIC VOTING

By the late 1990s, 95 percent of voters were using voting machines. Voters were generally familiar with the machines that had been used for many years, so local authorities did not need to provide much additional voter education. Local authorities were responsible for ensuring accessible voting facilities were provided for persons with disabilities. Polling staff (many of whom were from political parties) received training from local authorities on the procedures and functioning of voting machines. Only minor problems were encountered on Election Day – local authorities had spare machines in case of machine break down, as well as batteries in case of power failure. Technical staff was distributed throughout the country with back-up equipment. They could be reached via telephone if their support was needed.

Because the voting machines were widely seen to work well, few questions were ever raised about their security or compliance with international standards. Still, concerns were raised on several occasions, particularly by the Electoral Council and in Parliament.

The Electoral Council's concerns focused on the lack of any kind of testing or certification for the tabulation software, as well as the Integral Voting System (*Integraal Stem Systeem*[50]) that was offered as a package to local authorities by NEDAP/Groendaal. While the Electoral Council advised the responsible minister on several occasions to introduce a certification procedure for the tabulation software, no action was ever taken by the MOIKR, as it was not considered a priority. In March 2003, the Electoral Council wrote a letter to the minister detailing certain mistakes in the tabulation software that had been discovered during elections in 2002 and 2003 and emphasized the lack of control mechanisms.

Questions were first raised in Parliament in March 1998, after some issues had arisen regarding tabulation and recounting during the local elections. Then, the media raised questions during the May 1998 parliamentary election about the lack of a recount using electronic voting machines. The State Secretary requested an opinion of the Electoral Council on the issues of tabulation and recounts, and expressed his concern about the near monopoly position of NEDAP/Groendaal in the tabulation process. The Electoral Council recommended a review, and, as a result, the ministry created a sub-commission, which included representatives of the HEC, the Electoral Council and the MOIKR. The sub-commission published its report, written by the HEC, in May 1999. The report stressed that calculation errors sometimes appeared in the tabulation software and that only the supplier had access to the source code. It recommended that a certification procedure be created for the tabulation software. While the minister

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50 This system supports the voting machine software and contains a complete set of all political parties and lists of candidates. It also calculates and tabulates the results.

addressed these issues to the Parliament in September 1999, and his proposals received initial support from political parties, no action was taken to follow up on the issues by the Parliament or the MOIKR.

Questions again were raised in 2004 in Parliament because of concerns in Ireland regarding the reliability and security of the NEDAP machines purchased there. The Minister responded that "In the Netherlands, a lot of attention has always been paid to the reliability of these voting machines."[51] The Irish government subsequently decided not to use the machines for the 2004 European Parliamentary elections, but the Dutch Parliament did not take any further action. Questions raised in Parliament in August 2005 regarding the lack of a possibility for a recount were similarly discounted.

OPPOSITION TO ELECTRONIC VOTING

In July 2006, the campaign "We do not Trust Voting Computers" was initiated by Rop Gonggrijp, founder of the first Internet provider in the Netherlands, and a number of other computer experts.[52] The group started its campaign following the March 2006 municipal elections, when electronic voting machines were introduced in Amsterdam for the first time. Although the vast majority of municipalities in the Netherlands used electronic voting machines by this time, Amsterdam had long remained one of the few that still used traditional pencil and paper voting.

The initiators of "We do not Trust Voting Computers" were concerned about the security of the electronic voting machines in use and their lack of auditability. The group sought to publicize their concerns and generate public debate about their use. The campaign set up a website (http://wijvertrouwenstemcomputersniet.nl) and sought to further investigate the use of electronic voting computers through a series of State freedom of information requests.

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51 TK 2003-2004, Aanhangsel van de Handelingen, nr. 1453
52 The group established itself as a non-partisan foundation on 29 August 2006.

Both the Amsterdam City Council and the MOIKR responded to the freedom of information requests, providing copious documentation about the electronic voting systems, which the campaign posted on their website in late July 2006. The documents revealed several serious security flaws in the systems, as well as demonstrating the extent to which the government had outsourced the election process to equipment suppliers.

Although the campaign generated a certain amount of media interest from the start, the publication of documents and the reaction to it by the technology suppliers brought increased media interest and coverage. SDU accused the campaign of disclosing confidential documents and pursued legal action (ultimately unsuccessful) to remove the documents from the website. NEDAP similarly criticized the actions of the group, accusing it of a conspiracy and assuring the public that voting machines are extensively tested. TNO also protested against the freedom of information request, and, in particular, the publication of its testing reports of the voting machines, which it said contained confidential information.

The first public reaction from the MOIKR came in late September 2006, following the broadcast of an investigative report on the TV channel TROS RADAR, which raised questions about the security of voting machines. The MOIKR released a statement assuring the public of the security of voting machines and announcing that additional safeguards would be put in place prior to the general elections, including sealing of voting machines, extra protection of the software and extra checking of the software by TNO.

In early October, "We do not Trust Voting Computers" released a security analysis,[53] detailing the findings of independent computer experts who bought two NEDAP ESB3 voting machines from a city council and investigated the machines vulnerabilities for five weeks' time. These findings were highlighted and

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53 Gonggrijp, Rop, et al., "Nedap/Groenendaal ES3B voting computer: a security analysis", available at http://wijvertrouwenstemcomputersniet.nl/English.

widely publicized in an investigative news report broadcast on national Dutch television.[54] The 17-minute broadcast shows how experts were able to replace a memory chip in the voting machine in less than five minutes that allowed them to manipulate the results of an election. The program raised serious questions also about the system's complete lack of security safeguards and the lack of physical security of the machines while in storage and during transport. The program also questioned the testing of the voting machines by TNO, as TNO only tested one voting machine (out of 8,000) every four years, and did no security testing. Finally, the broadcast showed experts playing chess on the voting machine, having reconfigured the computer for this purpose to demonstrate that the voting machine was an ordinary computer.

The accompanying written security analysis demonstrated the security vulnerabilities of the NEDAP ESB3 and detailed several possible ways to attack the system. Such attacks included the ability to compromise secrecy of the vote through the detection of radio emissions outside of a polling station. According to the experts, a relatively simple radio device could be used for this purpose. The analysis concluded that, given the vulnerabilities of the system, the NEDAP ESB3 could not be made to meet any responsible security criteria and should not be used for Dutch elections. It further concluded that the Dutch legal requirements, which the NEDAP ESB3 met, did not consider any security issues and were insufficient for regulating the use of electronic voting machines.

REACTIONS TO CONCERNS

The government responded quickly to the vulnerabilities identified by "We do not Trust Voting Computers." MOIKR Minister Atzo Nicolaï announced a number of ad hoc measures for strengthening the security of voting machines and requested Dutch intelligence service AIVD, the General Intelligence and Security Service, to conduct independent testing of the voting machines.

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54 Dutch TV-news program Eén Vandaag, see video clip at: www.veoh.com/watch/v505707dgewqMsB

Short-term measures for strengthening the security of the voting machines prior to the November general elections included replacing memory chips with non-reprogrammable ones, sealing all of the machines and improvements to physical security procedures. These were proposed by the government and approved by the Parliament.

Testing by AIVD discovered the possibility for intercepting radio emissions from the NEDAP machines and compromising secrecy of the vote to be relatively remote, and identified an easy solution – the removal of diacritical marks from the names of political parties. Three out of the four types of the NEDAP voting machines passed the test. Because the fourth type was no longer used, the minister felt it was not necessary to withdraw approval for the NEDAP machines. However, the AIVD also tested the SDU machines and found a more serious problem related to intercepting radio emissions. The voting computer used a different signal per candidates list, which could be recorded at a distance of tens of meters. AIVD determined the SDU machines, therefore, were not adequately secure for use in the elections.

In reaction to the AIVD findings, Minister Nicolaï withdrew his approval for the SDU machines on October 30, just three weeks prior to the elections. One-thousand and two-hundred voting machines were affected by the decision. Several large cities had to either revert to pencil and paper voting, as Amsterdam did, or switch to the NEDAP machines.

At the same time, Parliament requested the government to establish two independent commissions after the elections to consider the past and future of electronic voting.

COMMISSIONS OF INQUIRY

Following the November 2006 general elections, two commissions of independent experts on electronic voting were established by Minister Nicolaï. The first, The Voting Machines Decision-making Commission, was set up on December 19, 2006. Its purpose was to review how decisions on the approval of voting machines had been made in the past, and what lessons could be learned. The second, the Election Process Advisory Commission, was established on January 18, 2007, to examine the current organization of the election process and make proposals for future elections in the Netherlands.

The Voting Machines Decision-making Commission was chaired by a high-level politician of the Liberal Party (VVD) and included a professor of public administration who specialized in public/private issues. The Election Process Advisory Commission was chaired by Honorary Minister F. Korthals Altes and was composed of five additional members drawn from academia, the private sector and public administration.

The Voting Machines Decision-making Commission published its report *Voting Machines: an Orphaned File* on April 16, 2007.[55] The report was critical of the government's past role in electronic voting, concluding that voting machines did not receive the attention they deserved. It found that the MOIKR did not have enough technical knowledge, leading to a situation in which officials became too dependent on external actors for the conduct of elections. In this situation, technology vendors became part of the decision making process and the ministry was not in a position to exercise effective oversight. It also criticized the government for not reacting to signals that should have caused concern, including the critical report on NEDAP voting machines that was released in Ireland in 2004.

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55 Report available in Dutch at www.rijksoverheid.nl/documenten-enpublicaties/rapporten/2007/04/17/stemmachines-een-verweesd-dossier.html

The Voting Machines Decision-making Commission was also critical of the laboratory TNO's role in the certification and testing process, finding they were certifying and testing the voting machines according to outdated standards that had not been updated to deal with modern IT and security threats. The certification and testing reports were not made public, depriving independent experts the opportunity to verify the analysis. The report was also critical of the legal framework, which did not deal adequately with the specificities of the electronic voting process, particularly the necessary security requirements.

The Election Process Advisory Commission released its report Voting with Confidence on September 23, 2007.[56] The report laid out a number of principles[57] that the commission believed should be safeguarded in the election process, and discussed the various methods of voting used in the Netherlands (i.e. paper ballots, electronic voting, postal voting, Internet voting, voting by telephone and proxy voting) in light of these principles.

The Election Process Advisory Commission noted, with particular concern, that requirements for election-related equipment had not been adequately established and that the security and management of the equipment were not properly regulated. It also noted that electronic voting machines in use were not sufficiently transparent and verifiable, as there is no way to determine that votes have been accurately recorded and/or stored. It further suggested that audits be conducted during elections to detect any errors or incidents related to the results and to learn lessons for the future.

The Election Process Advisory Commission concluded that voting at polling stations should be the main method of voting in the Netherlands, that each municipality should have the same method of voting and that voting by paper

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56 Report available at http://wijvertrouwenstemcomputersniet.nl/English.
57 Transparency, verifiability, fairness, eligibility to vote, free suffrage, secret suffrage, equal suffrage and accessibility. These principles are enshrined in the Dutch Constitution or in international and European treaties and recommendations.

ballot is the preferable option, on the grounds of transparency and verifiability. However, given the problems caused by manual counting of the ballots, the commission investigated whether other electronic options would be feasible and still safeguard the principles. It suggested that a ballot printer and ballot counter could be feasible, as they would produce a paper ballot that could be checked by the voter. However, no such alternative electronic option has been adopted to date.

DECISION TO END ELECTRONIC VOTING

The government acted quickly in the wake of the release of the Commissions' reports. During the press conference in which the Voting with Confidence report was released on September 27, 2007, the State Secretary for the Interior announced that the 1997 Regulation for Approval of Voting Machines would be withdrawn.

"We do not trust voting computers" had filed an administrative law procedure against the approval of NEDAP machines with the District Court of Amsterdam in March 2007. On October 1, 2007, the District Court decertified all NEDAP computers in use in the Netherlands as a result of the judicial procedure. With the approval of SDU voting machines already withdrawn, this decision left no voting machines certified for use in the Netherlands. On October 21, 2007, the 1997 Regulation for Approval of Voting Machines was officially withdrawn by Parliament, and the Decree of October 19, 1989 was amended, taking out the provisions that gave the minister responsibility for new regulations on approving voting machines. This legislative action removed the possibility to certify any new voting machines.

NEDAP filed an appeal against the decertification order of the District Court and also lodged a complaint with the MOIKR against the withdrawal of the 1997 regulation. However, these appeals were ultimately unsuccessful.

The MOIKR decided, based on the recommendations from the two advisory commissions, that use of paper ballots is preferred. However, several specific groups of society face challenges using paper ballots. Therefore, the MOIKR is currently conducting research into a new ballot design. The purpose of this new design is to facilitate voting by voters who are blind or have visual impairments, assist voters challenged by the Dutch language, provide the possibility to send the ballot electronically to voters living and working abroad and to facilitate counting of the ballots, possibly by the use of technology. At the moment, testing of several new designs of ballot papers is being conducted and new legislation for the use of the new design is being prepared.

LESSONS LEARNED

- The Dutch legal framework was inadequate to effectively regulate the development and use of voting machines, especially regarding security safeguards, the certification process and tabulation software.

- In the absence of a strong regulatory framework, suppliers failed to update technology in line with modern security requirements, making the voting machines vulnerable to internal and external security threats, as well as criticism.

- The MOIKR lacked the technical expertise necessary to fulfill its responsibility to oversee the conduct of elections, and as a result, suppliers had too much control over the process.

- Civil society, media and independent IT experts were absent from the decision making process on voting machines, and virtually no transparency mechanisms were provided at any stage in the process.

- The ministry ignored signs on several occasions that there were problems with the voting machines, including when problems were discovered with similar machines in Ireland and when the Electoral Council raised issues.

- Political parties and other stakeholders did not pay adequate attention to the integrity and security of the voting system, as they had a very high degree of trust in it, as well as in the election authorities.

- With only a few people involved in the effort, "We do not Trust Voting Computers" mounted an extremely effective advocacy campaign using freedom of information legislation and the media. This demonstrates that, in some contexts, civil society activists and other oversight actors can have significant influence if they engage actively, are well-informed, and provide credible, well-supported arguments.

- The Voting Machines Decision-making Commission and the Election Process Advisory Commission provided an objective, prompt review of the election process, which, based on the above lessons learned, should have been conducted much earlier.