

The UK deployment of the e-electoral register

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Abstract: In this paper we analyse the experience gained in the 2002 and 2003 UK e-voting pilots in the implementation of the e-electoral register of voters. After theoretically establishing the need for an e-register, based on the analysis of the evaluation reports provided and direct observation undertaken in one of the pilots, we describe the systems used and identify the different organisational and technical issues that arose. Accordingly we highlight lessons learned, to be used for future implementations of the e-register.

1 Introduction

In August 2002 the UK government issued a consultation paper on a policy for electronic democracy [HM02]. This consultation document usefully argued that e-democracy could be divided into two distinct areas - one addressing e-participation and the other addressing e-voting. In the case of the latter the paper argues that e-voting should be viewed as a technological problem. In the case of the former, the document set out the possibilities for greater opportunity for consultation and dialogue between government and citizens. With regard to e-voting 16 pilots took place in May 2002 [Pr02] and 18 more in May 2003 [E103a], on a Local Authority level. These were in all cases legally binding elections. The different e-voting technologies piloted involved electronic counting schemes (in some cases combined with traditional paper ballots) touch-screen voting kiosks, internet voting, phone (touch tone) voting and SMS text message voting in 2002 [Pr02]. Digital television voting and smart card technology for partial voter identification were additionally introduced in 2003 [E103a]. Several local authorities (4 in 2002 and 13 in 2003) offered these technologies as alternative channels of voting, therefore providing a multiple channel e-voting process. In the pilots where two or more channels of voting were offered simultaneously an electronic on-line version of the electoral register was developed and used to provide the necessary infrastructure. The on-line electoral register was piloted in Liverpool and Sheffield in 2002, [E102a & 02b] and in Sheffield and St Albans in 2003 [E103b & 03c]. The focus of this paper is the analysis of the deployment and use of the e-electoral register.

2 Research methodology

The research presented in this paper forms part of a doctoral programme concerned with the identification of the emerging constraints in re-designing the electoral process in relation to ICTs. After completing an extensive literature review of the issues involved in the implementation of electronic voting, we have proceeded to the analysis of the detailed evaluation reports of the 2002 and 2003 UK e-voting pilots, provided by the Electoral Commission. Further research data have been provided directly by some of the 2003 pilot Local Authorities. Our research findings reported here on the e-electoral register are based on its use in one of the 2003 pilots. The Local Authority studied was piloting an on-line system of the electoral register, to support a simultaneous multiple channel e-voting process combined to provide e-enabled polling station voting. The fieldwork which comprised interviews and observations, was conducted both during the run-up to the election and on the actual polling day. Semi-structured interviews with Local Authority and commercial suppliers' staff were undertaken on the first day, during which, there were interruptions to allow for managerial problems to be resolved. In such cases the observer was allowed to follow the e-voting management in action. On election day, observation took place at the operations management centre, which was set up to handle the technical and organisational issues that arose. After 9pm that day, when voting was over, the observer was part of the verification processing team. That in turn provided the opportunity to acquire hands on experience of the administration of the e-register system used.

3 The need for the e-register of electors

The Electoral Commission in a report specific to the electoral registration process [EI03d, p:18] recommends: "Electoral registers should be universally electronically maintained according to mandatory national data standards". It also refers to issues concerning registration fraud and measures that could be taken to prevent against such fraud. In the previously mentioned UK Government consultation paper, a system described as: "a local or national electronic electoral roll" p43 is suggested as necessary infrastructure for voting at any polling station. Also, the on-line electoral register is considered to be one of the major components of a modern e-voting system, along with "on-line registration and application for postal votes, on-line and text voting, e-counting and collating of election results" p45. The major benefit given for a central electronic electoral register is that election officials could authenticate a voter at any polling station. Research in this area has been undertaken by the LASER (<http://www.idea-infoage.gov.uk/services/laser/index.shtml>) project aiming at the production of a fully interactive online register. The need for the e-electoral register serves the basic security requirements that "only people who are entitled to vote can vote" and "nobody can vote twice or in another person's name (unless an authorized proxy)" [HM02, p46].

From a legal point of view voter identification is necessary in order to avoid personation [Xe03]. The Watt [Wa02] report defines the different cases of personation, while making the case for the legal requirement of 'one ballot per vote' and a verifiable count.

Furthermore, who is included in the electoral register is directly related to the issue of voter eligibility [OS01]. In accordance with the above, the statement of requirements for the design of the e-voting systems to be used in the 2003 pilots included a “Compliance with Legislation” term [OD02]. Technical security standards were also set according to CESG security solution [Cr02]. Managerial issues were also covered in the 2003 statement of requirements, including data management, risk management and staff training. The same set of requirements had a separate section for the electoral roll with several detailed functions that had to be developed by the suppliers and provided to Local Authorities. The most relevant functions with regard to this paper covered the necessity to convert any electoral roll into a format which is suitable for use in the pilots, immediately mark an elector as having voted as soon as the ballot is counted, provide upon request a daily marked register and allow a live continually updated register to be accessed remotely by the Returning Officer or the Local Authority staff.

4 Issues in the 2002 pilots

In the Sheffield 2002 pilot [E102b] three e-voting channels were simultaneously offered (internet, SMS text and kiosk voting) for a period of 6 days leading up to election day, along with voting in polling stations on election day. The existence of the on-line e-register enabled voters to cast a ballot at any polling station within their ward. Three wards out of twenty-nine were participating in the pilot. The voting channels provided in the Liverpool 2002 [E102a] pilot were similar to the Sheffield pilot with the only difference being providing telephone voting instead of kiosk voting. These were offered for the same period of time but only in two wards out of thirty-three. The e-register used a VRN (voter reference number) as a unique elector identifier, which was consumed once an e-channel had been used. That excluded double voting between e-channels. On election day a voter who requested a ballot from a polling station, was checked against the on-line e-register during the identification process. That excluded the possibility of a voter having already voted at another polling station or doing so later in the day. Polling officials by marking the e-register when giving a ballot would automatically consume the e-credentials of the voter and exclude the possibility of double voting between polling stations and e-channels. If a voter had previously applied for a postal vote then their e-credentials would also be consumed. In Sheffield a voter could go to any polling station of the participating wards and tell their name to the polling official. The polling official would in turn look the voter’s VRN on a paper-printed list and input in the e-register interface. This made the process more time consuming than the traditional crossing off on the paper register. In Liverpool the same process was followed, but as an extra element of procedural security, voters were also crossed off a paper version of the register as would be done in the traditional voting process. This made the authentication process even more time consuming, about thirty seconds per voter, instead of five seconds needed had the traditional process being used. This, in turn, resulted in long queues building up during the evening.

4.1 Organisational Issues

A consortium made out of two commercial e-voting providers delivered both pilots. In Liverpool however a third commercial provider was involved in supporting the pilot effort (voter call centre). In Sheffield two PA departments were involved in the project (election office and IT) while in Liverpool four PA departments were involved (election office, e-government, marketing, press office), with the traditional voting channel managed separately. In both cases the project was lead by the main commercial supplier and there was a great amount of trust and dependence of the PA on the commercial suppliers due to time constrains in delivering the project. Risk management was adopted based on thirteen high-level risks, which were eventually detailed in late April –the election day was 2nd May. The 2002 risk tables were not provided in the 2002 evaluation reports. Polling station staff training was limited; in Sheffield one hour in the use of the register was provided prior to election day along with an instruction manual. In Liverpool two hours of un-paid training were provided but there was no time for process simulation. Limited staff training was considered to be an additional reason, which caused delays in the authentication process and also the reason for some of the technical problems encountered.

4.2 Technical Issues

Laptops and ISDN lines were used to connect polling stations to the on-line e-register. In Sheffield, there were also some cases of polling staff having difficulties in setting up the laptops, however a help-line provided assistance to polling station staff. Overall, only 4 cases were reported of voters being denied the right to a ballot as the e-register recorded them as having already voted. All these cases were attributed to processing errors. To cover the risk of hardware failure, contingency plans included one technician with a spare laptop per ward on polling day. To cover the risk of temporary system failure, provisions for keeping paper records of those who had voted at polling stations were taken for later entry once the system was restored. If the system was however permanently down then provisions were taken to convert immediately to traditional elections without the option of voting at any polling station. In Liverpool similar contingency planning was in place. ISDN connection problems were reported in two cases and were attributed to poor staff training; apparently polling station staff had damaged the equipment provided in their effort to install it. Technical support was provided to rectify the problems with backup hardware. In another case, a polling station received the wrong laptop. The polling clerk did not follow the agreed contingency procedure (telephone the central office and verify the eligibility of each elector) and for two hours issued ballot papers keeping manual notes of the voters who had been given a ballot only to update the database once the problem had been restored. Although all voters were later proved to have been eligible for the ballot they had received, there was a clear possibility for them to double vote during that time through another voting channel. The 2002 Liverpool pilot indicated that human errors could lead to technical risks and procedural disruptions. Had the lesson been learned for this case, problems might have been prevented in the 2003 pilots involving the use of the e-register.

5 Issues in the 2003 pilots

In the May 2003 elections St Albans [E103c] provided a multiple channel e-voting process including touch-tone telephone, kiosk and internet voting for a period of three days leading up to election day, along with simultaneous voting in polling stations on election day. The existence of the online e-register enabled voters to cast a ballot at any polling station as all twenty wards and twelve parishes were involved in the pilot. Additionally SMS text voting was offered in Sheffield [E103b], along with smart cards, which were used to facilitate the authentication process at polling stations and kiosks. The Sheffield 2003 pilot lasted for a voting period of seven days, with election day being the last one, however only fifteen out of twenty-nine wards participated in the pilots. The e-register system used in both pilots was the same as the commercial supplier provided it. The system provided seven functions: voter search, marking the register, credential management authentication, issue of replacement credentials, issue of tender credentials, checking the contest history of a voter and viewing an audit log for each voter.

In both cases laptops were necessary in order to maintain and update the electronic version of the electoral register in real-time from each polling station. This was necessary to avoid double voting as any voter could, up to the last moment (9pm on election day), cast a ballot through any of the voting channels offered. In practical terms this means that if a voter cast a ballot via a kiosk and then attempted to vote in person at a polling station the polling official equipped with a laptop connected to the database of electors (e-register) through the internet, would know that this voter had already cast a ballot and would subsequently deny a second ballot to this voter. More importantly, as voters were offered the option of voting at any polling station in all wards experimenting with the use of the electoral register on election day, the updated e-register would prevent a voter from voting at more than one polling station.

In Sheffield laptops were also used in polling stations to introduce an innovation at the authentication process. Each laptop was connected to an external smart card reader and voters were provided with the option of bringing their smart card to the polling station. The smart card could be used by the voter in front of the polling official and once passed over the smart card reader (non-contact smart card technology was used) the voter's details would automatically be recalled from the on-line e-register. The polling official would then ask the voter their name and address to verify against the screen information from the e-register database, and in this way complete the authentication of the voter. This should have been a 10 seconds process for each voter. The aim of the smart card was therefore to produce time efficiency in the polling station voting process. The smart card's memory element contained the voter identification number. It could also be used in kiosks. Once inserted in the smart card reader of the kiosk the voter ID would appear on the screen and voters would only have to supply the system with their password. However in all cases the use of the smart card was optional. At a polling station a voter could just walk in, state one's name and address, then the polling official, using function one, enter these details and authenticate the voter looking at the e-version of the register rather than the paper version of the register.

This was supposed to be a 30 seconds process and such was the case in St Albans where no smart card was introduced. Similarly at a kiosk a voter could type in one's voter ID instead of inserting one's card in the smart card reader. In all cases the smart card did not contribute any extra element of security but was rather provided as a means of convenience.

5.1 Organisational issues

A total of eight commercial suppliers had to work together to provide the Sheffield pilot [E103b], while the PA contributed with the election office, and staff from the IT department and the office of the Returning Officer. In St Albans [E103c] seven commercial suppliers were involved and the PA contributed with the IT department and a dedicated e-voting working party. Commercial suppliers were either directly contracted or subcontracted by the main providers. The main suppliers were the same for both Local Authorities.

Following basic IS project management principles [Av03] one would expect contingency planning at least equivalent to the one identified in the 2002 pilots. The statement of requirements for the 2003 pilots [OD02] asked for the implementation of a methodology compatible with PRINCE2 [Be02]. St Albans PA did provide an approach consistent with PRINCE2 while Sheffield PA followed its own methodology. In both cases risks were managed as they arose. However the matter of reliance of the PA to commercial suppliers for the safe delivery of the pilot remained and was characterised as over-reliance by independent evaluators working for the ODPM [E103b].

With regard to polling station staff training, the evaluation reports indicate that a greater effort was undertaken than the previous year. St Albans provided a detailed training programme, while Sheffield provided a two-hour walkthrough of the system for at least two out of three polling clerks of each polling station. However trainees were not given the opportunity to browse the system prior to election day, and gain familiarity with the different features. Instead they were provided with an interactive CD and a detailed manual. For Sheffield in particular no training was provided on the connection of the smart card reader to the laptop.

The organisational problems that arose were similar in both pilots. In Sheffield [E103b], there were delays in the delivery of laptops and smart card readers, while the number of back-up systems proved to be insufficient. Laptops were incorrectly configured by the responsible subcontractor, who also provided half the promised technical support staff with no transport and no knowledge of the area. Polling stations were not provided with a back-up paper copy of the register, as was the case in the previous year. In St Albans [E103c], the hardware required at polling stations on the morning of election day, was installed but not operational (41%), delivered but not installed (43%), or in very few cases not even delivered (5%). According to the project plan polling stations would be equipped with the necessary hardware the day before election day or even very early in the morning of election day (5am-8am). The reason was the unavailability of dedicated locations to serve as polling stations, which posed time constraints as to when the installation could take place. The time and the resources needed to set up polling stations

were underestimated. Inadequate logistical planning resulted in engineers being sent to polling stations without local maps and site installation diagrams. In both cases there was concern about the internal communication between the main contactors and their subcontractors.

Organisational problems, along with the technical problems described in the following section, resulted in a significant number of polling stations not being connected to the e-register in the morning of election day. In Sheffield the back-up procedure was that polling officials would call the election office and the election office staff would enter the voter in the e-register. However election office staff was unavailable and hand written notes were kept by polling clerks on those voters who had been given a ballot. There was also a written instruction given out to polling officials asking them only to give a ballot paper to a voter when marked on the e-register and not before and if in doubt contact the election office. Following instructions some polling officials did not give out ballot papers and some voters were sent away advised to come back at a later time in the day or use an alternative voting channel. According to the Electoral Commission this resulted to 200 voters being sent away [E103b].

In Sheffield, the main source of confusion in managing problems derived from the fact that there was no provision for established channels of communication between the polling stations and the election office. In St Albans mobile phones were issued to polling station officials. Sheffield on the other hand relied on the provision of telephone lines at polling stations.

The solution suggested, to provide election officers with a paper copy of the register, would have to be a copy of all registered voters in all participating 15 wards. If such copies were not already available, they would have to be printed out and then delivered to the polling stations facing problems in the use of the electronic form of the register. The copy of the register provided to the polling stations in question would be marked with the voters who had already cast a ballot through a different voting channel during the previous days. Although this measure would not provide total security against possible election fraud, as voters could vote again and again at polling stations where there would be no form of real-time updated register, it would limit the possibility of fraud, as it would exclude those who had already voted from voting again. However, the suggested solution was not feasible because of the large number of polling stations reporting problems with the e-register. In contrast, St Albans did provide the polling stations facing problems with the e-register with marked paper copies of the electoral register early on election day [E103c], but these reflected the status of the register at one particular time (10.15am) and were not subsequently renewed later in the day.

In relation to the voting process, when smart card readers did work, then the process could also be delayed instead of expedited as expected. Voters did not know how to use the card because there was no voter education on that matter. The smart card used in Sheffield was of the latest technology and in effect that was the problem as the technology was so new that people had no user experience of it. It was a "proximity card". A voter did not have to insert it in a slot, as would have been the case in using a kiosk or any automated cash dispenser. In effect the card was contact less and it had to

be passed slowly over the smart card reader. Typically voters would put the card on the reader or pass it over quickly and the reader would not recognise the voter ID contained in the card. More efforts were needed to get it right and as a result more time. The problem could have been limited had training on the use of the card been provided to the polling officials, who could then help voters effectively.

At the close of polls, all the polling stations, which had kept manual notes on the voters who had voted without being properly authenticated, returned these notes to the election office. Normally the notes would have the name, surname and street address of each voter. The verification process started at 9pm after the e-voting channels closed. The database would then be searched usually with one term (surname) and accordingly verified on screen in relevance to the rest of the data. If the voter was shown as not having voted then he/she would be marked and there was no problem. If the voter was shown as having already voted there were available audit trails providing information as to the channel this voter had used.

However this was a time critical procedure because the result could not be announced before this process was over and the possible damage done during the day (double voting) fully measured. There was no consistency in the form of notes provided by different polling stations. All of the notes were hand written which in some cases caused confusion as to what was written. The objective of the verification process was to check and mark the register as should have been done during the authentication process prior to granting a ballot. If the register were already marked that would mean that a vote had already been cast on an e-channel and that the paper vote should be counted as valid. The general rule in the multiple channel voting was that if double voting had indeed happened then the e-ballot would be ignored and the physical (paper) ballot counted. This rule would cover the case where someone had voted twice, once in a polling station and once in any of the e-channels. However the case of a voter casting a ballot in two or more polling station was not covered, as all these ballots would be paper ballots. The process followed is an example of a procedural security measure [Xe04] adopted to cover for a technical inefficiency.

5.2 Technical issues

Regarding internet connectivity, in some cases the e-register, would respond more slowly than expected. This could be attributed to any number of different reasons, for example, the database server being overloaded (performance degradation). In such cases manual notes were kept to enter later when the system performance allowed it. That mainly caused periodic crashes around the end of the day and it was attributed to data indexing problems at the bottleneck of the back-end application. ISP poor performance also resulted in a slower process by not transporting data at the expected internet speed. ISPs guarantee connection to the internet but not internet performance. Dedicated fixed connections or the use of an owned ISP was suggested as a future, nevertheless more expensive, solution.

Connectivity problems also included some polling stations losing their connection from time to time. In cases where there were long periods of time between two voters coming to be identified the connection would automatically drop. This lack of continuous connectivity meant that polling officials would have to re-log on to the database when the next voter needed to be authenticated. On entering the database for the first time polling officials were prompted to change their password. In one similar case the polling official forgot the new password that he/she had provided and therefore could no longer gain access to the e-register.

In Sheffield, hardware problems were also reported in relation to the smart card readers. The smart card readers were an external element linked to the laptops with a cable connection but they had a different power supply, which proved fragile. Polling station staff had to take the laptop and the smart card reader out of their cases, place them on a table, link them in the appropriate way according to each different laptop make, and then plug-in both power supplies and start the computer. The problem was not the reader itself but the separate power supply provided for the readers. Nevertheless a defective smart card reader did not stop a polling station from accessing the on-line e-register, but only changed the way voter searches were done.

Finally, with regard to the risk of power cuts, which was discussed at length in the 2002 Electoral Commission evaluation reports, the use of UPS units was reported only in St Albans. Nevertheless, normally charged laptop batteries could have kept the polling station operational for about four hours.

6 Conclusions

An e-enabled election is made more difficult to deliver as the scalability of the project increases. The deployment of the e-register studied in this paper, highlights the following issues:

- There is a need to establish standard communication channels between all the agents involved in the delivery and management of the e-register. The provision of alternative networks of communication such as the use of mobiles in St Albans proved useful practice, which facilitate the management of the problems faced and the need for feedback and problem escalation mechanisms between the agents related in the delivery of the pilot.
- There is an obvious need for a co-ordinating agent when many different agents are involved in delivering intersecting e-voting processes.
- The type and quality of internet connection used and the well-organised technical support provided, will determine the time needed to authenticate voters.
- Backup procedures such as a paper version of the register must remain available before problems arise, at least until the new process is well established.

- Systematic staff training in the new methods of voting to a level of being able to provide on-sight voter education and process knowledge gathering can provide valuable input to future best practice.
- Problems in e-enabled voting, resulting in process risks are related to the one-off use of voting locations (polling station) for the purpose of voting and every extra piece of equipment used.

From a more generic point of view, loosing voters who would have voted if not prevented by malfunctions in the e-enabled electoral process, could become a major political issue when affecting larger number of voters. This fact could in turn undermine the validity of the result of the electoral process as a whole, even if only one of the voting channels were problematic. The lessons learned from the deployment of the e-register in the UK can serve as a set of valuable guidelines for the future design and deployment of e-voting systems.

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