Using Business Process Re-engineering (BPR) for the Effective Administration of Electronic Voting

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Abstract: This paper proposes the use of Business Process Re-engineering (BPR) methods and analysis tools to address the issues arising in the implementation of electronic voting. We consider the electoral process as one which has to be re-designed in order to effectively accommodate e-Voting technology. We identify the key areas of e-Voting where the use of BPR can provide beneficial results.

Keywords: e-Voting, e-Democracy, e-Government, elections, procedural security, responsibility.

1. Introduction

The purpose of this paper is to identify the electronic voting issues, which can be addressed through the use of BPR based methods and analysis tools. Within the democratic form of governance elections take place repetitively. In short, democracy fosters the electoral process. Electronic voting through its different applications aims to e-enable the existing electoral process. UK Government policy aims at an e-enabled general election some time after 2006 (HM Government, 2002), therefore defining it a medium term target. To ensure a smooth transition from paper-based voting to e-Voting a number of e-Voting trials have taken place. Sixteen e-Voting pilot schemes were carried out on the 2nd May 2002 Local Authority Elections. These were funded by the DTLR (Department of Transport Local Government Regions) and approved by the Electoral Commission (Electoral Commission, 2002). All 16 local authorities used electronic counting schemes – 7 of which were combined with traditional paper ballots only, 6 provided e-Voting in the form of touch-screen voting kiosks, 5 provided internet voting, 3 provided phone (touch tone) voting and 2 SMS text message voting (Pratchett, 2002). In the local elections held on the 1st May 2003, 20 e-electoral pilot projects were approved. In total 8 Local Councils piloted e-counting of paper ballots, 8 offered kiosk voting either at polling stations or in public spaces, 14 provided internet voting, 12 piloted phone voting, 4 SMS voting and 3 digital television voting, the latter being tested for the first time in the UK (Electoral Commission, 2003).

The 2002 pilots aimed at evaluating the e-Voting methods piloted on the basis of five strategic goals such as increase in voter turnout, ease of use, the possibility of electoral offences, cost savings, and the general success of the pilots in terms of facilitating voters to make informed decisions, facilitating voting and counting of ballots (Electoral Commission, 2002). Considering all cases of the 2002 e-Voting pilots, the traditional electoral process was either complemented or substituted by a multiplicity of electronic voting processes. Voters were provided with different voting processes all resulting in the same outcome, the casting and counting of their vote, all governed by the same set rules.

2. The need for BPR

One can identify the need to redesign the electoral process into a full-scale e-electoral process, delivered through simultaneous multiple technological channels, all-contributing to the formation of a unique election result. As such, the electoral process can be considered as a "business process". Subsequently, many of the business management functions can be applied to it in order to manage, control and re-engineer it. This paper considers in specific the application of Business Process Re-engineering (BPR) to the electoral process.

In the case of BPR, existing business processes are re-designed in the context of existing business rules. The aim is to provide the same result in a more effective and efficient way, efficiency and effectiveness themselves being set and measured on the basis of strategic business goals, making best use of existing technological solutions provided by the application of ICTs (Information and Communication Technologies) (Glykas, 1994). In the case of e-Voting existing electoral processes need to be re-designed in the context of both new and existing legislation. The aim is once again to provide the same end-result but in a more effective way. This is measured against a number of government, political and citizen inter-related goals, making this a much more complex operation.

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Elections are rule-governed events (Ballinger and Coleman, 2001) and electronic elections are governed by the same set of rules applying to traditional elections.

Elections are also government owned and initiated processes. Therefore the activities involved in their undertaking are public administration related. It is therefore evident that in order to properly re-organise elections one should bear in mind other cases of public administration processes that were redesigned due to the application of new technology with the aim of increased effectiveness and efficiency.

The use of BPR in the Public sector has been theoretically investigated mainly by Lenk (1997), Pratchett (1997), Zuurmond and Snellen (Zuurmond and Snellen, 1997). Lenk has discussed the enabling role of ICT in relation to the risks and opportunities involved stating the need for continuity of structures of accountability. Pratchett focuses on the use of BPR at the local authority level referring to the level of radical re-engineering, the suitability of processes to undergo re-engineering and the level of dependence on ICT. Zurmond and Snellen on the other hand take a more managerial approach discussing organisational structures and informational architectures within the bureaucratic paradigm. Klischewski and Lenk (2002) have recently extended the value of modelling administrative processes to provide better understanding of the process.

3. Issues involved in the implementation of electronic voting

In order to identify the specific e-Voting issues, which can be addressed through the use of BPR, we have primarily initiated a study of all issues arising in the implementation of electronic voting. Our main research material has been the evaluation data provided by the UK 2002 local authority e-Voting pilots (Electoral Commission, 2002) and existing e-Voting literature. The issues concerning the implementation of electronic voting are spread across five main areas closely related to the conduct of elections. We have therefore categorised the identified issues under legal, social, technical, political and administrative-financial. The first four categories are formally acknowledged as defining factors of the UK Government strategic vision on e-Voting (ODPM, 2002). To those we have added the administrative and financial category as we have found many issues which fall under this category, given that e-Voting serves the electoral process in a multiplicity of new ways, which in turn have to be cost effectively managed. A table of the issues involved in e-Voting is provided hereafter in order to establish their relevance to the use of BPR methods and analysis tools. Administrative and financial issues are however discussed in detail so as to further complement our argument.

Table 1: Issues involved in the implementation of electronic voting.

LEGAL	SOCIAL	TECHNICAL	POLITICAL	ADMINISTRATIVE-FINANCIAL
Commercial contract disputes Accessibility provisions Vote trading Voter identification Voter eligibility One ballot per vote Free to cast a ballot Unlawful influence Secrecy Tampering with election material-data Personation Verifiable count Openness to audit Accuracy Campaign law	Trust Transparency Social acceptance of the process and the result The voter's choice of preferred way to vote Voter education Privacy Usability Measures to avoid voter exclusion due to the introduction of e-Voting Increasing voter convenience	Security Openness to scrutiny Compliance to legal constrains System flexibility to fit local needs Reliability Availability Compliance to EML standards	Political support Voter turnout Voting data ownership Prolonged campaigns New methods of voting being more private Increase of information provided to the voter Loosing voters who would have voted if not prevented by malfunctions in the e-enabled electoral process	Cost analysis Data management Risk management Staff training Verifiability of the process-result Procedural security Efficiency in counting Scalability Interoperability Flexibility

4. Administrative and financial issues

The matter of cost is discussed as a defining factor in the implementation of e-Voting in major e-Voting literature related to the UK context (Coleman et al, 2002), (Pratchett, 2002), (Fairweather and Rogerson, 2002). According to the Electoral Commission, one of the main reasons for piloting e-Voting is to establish whether cost efficiencies can be established. However the Commission considers e-counting as having already established its related cost efficiencies (Electoral Commission, 2002).

The documentation on experience gained to date in the area of e-Voting costs needs to be addressed. Although detailed reports have been produced with regard to technical/security, legal and accessibility issues, to date no detailed study has been published with regard to e-Voting costs. We therefore suggest that the task of producing a cost accounting methodology is assigned to an expert organization of this kind in collaboration with the Electoral Commission. There is an apparent need to define specific cost metrics so that when we refer to the cost of e-Voting we use an agreed terminology. To date, criticism of e-Voting costs is fostered by the absence of specific cost metrics. We also suggest that any cost methodology should not only cover the e-Voting channels but also the combination of the e-channels with non-e-channels (postal and polling station voting). If a process stage approach is adopted between all the different channels then common costs can be identified and economies of scale can be calculated for different combinations of multiple channel elections.

Further e-Voting pilot schemes can provide an excellent opportunity for such a study, providing that precise cost estimates and final costs are kept during the pre-electoral period in a concise, pre-defined format.

A further administrative issue related to e-Voting is data management. There are six main sets of data involved:

- The data of all eligible voters in the form of an e- electoral register.
- The creation and distribution of authentication data for each eligible voter
- The management of unused authentication data
- The storage and count of e-ballots cast
- The data of voters who used their vote (for verification purposes- who did vote)

Each set of data if stored separately, potentially, poses no threat to the secrecy and security of the process. However the combination of two or more under the same data owner is not in the interest of procedural integrity.

The identification of risks, which could jeopardize the outcome, or the integrity of the process is covered as an official requirement for the 2003 pilots. In some of the 2002 pilots risk analysis did take place. In the case of Liverpool (Electoral Commission, 2002a), BT, being the main contracted vendor, originally provided a risk register of 13 known risks later to be followed by a detailed investigation of risks for each voting channel piloted with recommendations provided in a threat/recommendation matrix form on each voting channel. However, Sheffield Council developed its own risk table to enable contingency planning despite the fact that BT was also contracted for the Sheffield pilot as well (Electoral Commission, 2002b).

Further research is needed involving Returning Officers, election services staff and commercial suppliers implicated in the delivery of e-Voting pilots, focusing on two main issues:

1. Which problems and risks were encountered, which could jeopardize the election's successful completion?
2. Which existing problems/risks were exacerbated due to the introduction of any e-element?

Such a research effort would document the acquired knowledge and experience gained. Its results could provide a framework, which would identify, predict and manage risks, thereby drawing lessons learned from the implementation of e-Voting solutions.

The training of administrative staff is also an issue to be considered. By the term administration staff we mean the Returning Officers, polling clerks, counting staff paid by the local authorities and in general all local authority personnel involved in any stage of conducting the pilots. In all cases where any kind of technological equipment was used, which administrative staff had to operate (like counting equipment of paper ballots) or where they had to instruct voters on how to use equipment, the technology providers provided some training. In Westminster a counting centre handbook was produced and in Chester a manual was provided to assist polling staff in the use and processes of operating the touch screen kiosk (Electoral Commission, 2002c, 2002b).

In all evaluation reports surveyed there is no mention of any kind of knowledge gathering from the administrative staff other than anecdotal data. In this case there is an obvious lack of a system to

record any experience gained by the staff who operated the voting technology and so benefit from lessons learned. This in turn prolongs the dependence of local authorities on technology providers and deprives staff training exercises from colleague experience based learning (Xenakis & Macintosh, 2003).

Verifiability of the system and the result produced has to be administratively achieved, whether that is system testing prior to use (IPI, 2001), or verifying the count by securing the option for a recount. This is also related to the technology used. The touch-screen kiosk used in Chester and Newham (Electoral Commission, 2002d, 2002e) produced a paper audit, which increased the possibility of verification. In cases where no such option is provided the possibility of a recount looses all value as automated recount of e-ballots re-produces instantly the exact same result.

Procedural security although related to the technology used and the level of technical security applied, is mainly an administrative concern. It is the combination of technical security, specific security processes to be followed and physical security measures. In attempting to define the concept:

> *"We consider the term procedural security to include all security measures related to the conduct of e-enabled elections, which involve the redesign of an electoral procedural activity, or the introduction of a supplementary process activity or mechanism, aiming at upgrading the security level of the e-Voting process, given the technical limitations on security"* (Xenakis & Macintosh, 2004)

There were several cases of procedural security misconducts in the 2002 pilots. For example in Broxbourne (Electoral Commission, 2002f) access to the counted votes was allowed to two officials who theoretically could alter the votes with their actions being nevertheless logged. However this process was never instantiated and all operators of the system used the same user ID not allowing traceability of their actions. Accordingly there are cases of good practice. In the case of Newham (Electoral Commission, 2002e) three administrators had access rights and another three had "super-user" access rights but the system required two of them being present simultaneously for any changes to be made.

As a general rule the technical characteristics of an e-Voting application should be in full compliance to the existing legal requirements. For the 2003 pilots a comprehensive set of technical requirements determined standards for technology reliability, system availability, compliance to EML (Election Markup Language), system accuracy, efficiency in counting, future scalability and interoperability of the system and the overall speed of the process and production of results (ODPM, 2002). The requirements also called for the possibility of customisation of an e-Voting solution to fit local needs. In more general terms an e-Voting system application should provide technical flexibility (IPI, 2001) to allow adjustment to specific needs or requirements.

In parallel we have identified the main areas where process re-engineering has proven its value.

5. BPR benefits in a business context

In order to identify the e-Voting issues which can be addressed through the use of business process re-engineering analysis tools and methods, one can refer to the benefits deriving from their use in a business context. Although the points made hereafter are based on the application of different BPR methodologies, process re-engineering has proven its value, when used in an enterprise environment, in managing risk (Glykas, 1994). Although BPR does not claim to be a risk management methodology, some aspects of risk have been successfully encountered through its application. Managing economic risk is an issue for accounting influenced methodologies while personal risk has also been handled in cases of manufacturing process re-design. BPR has also contributed to the better understanding of the organisational environment and its constant change (Hammer, 1993). Glykas has extended the importance of providing support for and a contractual view of the process. The notion of process management is supplemented by concepts such as the process owner. By focusing on the obligations of different process owners towards others a better understanding of all the different roles within the organisation can be achieved. A similar benefit can, potentially, be expected by the modelling of roles of the agents involved in the delivery of electronic voting.

As stated above, BPR has contributed to the provision of techniques for continuous improvement (Hammer, 1993; Davenport, 1993). Since technology is constantly advancing, and the business environment is constantly changing, processes and the systems supporting them are in need of methods to facilitate and guide their parallel improvement. This in turn enables businesses to focus on the customer and adapt to the customer's changing requirements (Hammer, 1993; Harrington, 1991). In a business environment, where the customers' needs are the driving force, BPR has provided business

organisations with the opportunity to adjust dynamically to customer demands. In the e-Voting context this relates to need for flexibility of e-Voting systems to adjust to special needs and circumstances presented by the emergence of e-Government and citizen-centred public services.

Better control of the process (Hammer, 1993; Butler-Cox, 1991; Davenport, 1993; Harrington, 1991) is mainly achieved by dividing the process into much smaller processes for which monitoring is decentralised. In simple terms, more people taking care of a small part of a large process, provides a more complete control of the process as a whole. BPR has provided solutions either for re-allocation of existing resources, or for combination of existing resources to newly acquired ones, creating, in turn, cost savings. By providing a step-by-step approach to each process enables the identification of repetition and non-value adding steps which can be omitted in order to simplify operations. Therefore elimination of unnecessary work and bureaucracy through the introduction of ICT can be achieved (Butler-Cox, 1991; Davenport, 1993; Harrington, 1991). The focus here is on inter-organisation communication channels and the actual form that information exchanges have during the process. In electronic voting the exchange of information is not limited to voting data but also to the dissemination of information prior to the election event and inter-agent co-ordination during the election event. Therefore e-Voting could similarly benefit from the application of BPR.

Cost reduction is a central issue to the operation of any business. Allocating cost to different stages of a process enables the better understanding of cost sources and allows estimates of any differences in costing according to prospective changes in each process stage (Butler-Cox, 1991; Davenport, 1993; Harrington, 1991). In part, this is achieved by the identification of the actual hardware and software to provide better, faster and automated processes (Glykas, 1994). In view of the possible multiplicity of technological solutions, the need for determining the right technology for each process stage and for the organisation as a whole results in the re-design of processes, bearing in mind the introduction of new technologies. The growing number of technologies to enable the electoral process indicates the need for continuous procedural re-design, particularly with the prospect of scalable electronic voting.

Transparent allocation of responsibility has however provided far greater efficiency gains (Hammer, 1993; Butler-Cox, 1991; Davenport, 1993; Harrington, 1991). Defining responsibility in a very simple form, which is understood by everyone within the organisation, is one of the most commonly referred BPR benefits. By describing roles, within rule defined processes, in the context of contractual relationships between agents, the responsibilities of each agent in regard to each process are explicitly stated. Finally, based on the contribution of IS influenced methodologies, managing data either necessary for or produced during the process, is another issue addressed by BPR methodologies. This is related not only to the elimination of unnecessary bureaucracy, but also to the capture of business knowledge (Glykas, 1994). The allocation of responsibility between e-Voting agents has up to now been managed on a project-to-project basis and no consistent methodology to provide standards for e-Voting management has been identified in the literature.

In conclusion the benefits of applying BPR in a business context, and the similarities identified in the needs of e-Voting management, provide a sound justification for exploring the possibility of taking these benefits across to the e-Voting context.

6. e-Voting issues which can be addressed through the use of BPR

From the combination of known BPR benefits from the business environment and the general review of the issues concerning electronic voting we can define seven areas of mutual ground.

Cost: Based on the experience gained in the business world, BPR based tools could be researched to manage the economic risk of investing in voting technology and make a return on this investment. Cost reductions could potentially be achieved by cost allocation to different stages, agents and objects involved in the process. The modelling of the e-Voting process could also prove beneficial in the best allocation of resources, using tools such as mission non-mission activities analysis (Glykas, 1994) according to the different options of allocating resources in different process stages of different parallel processes.

Data: Issues such as data ownership and data management could be served by data flow mapping and data lifecycles in the form of object lifecycles (Glykas, 1994). This line of research would support the legal and administrative issues concerning data management as well as the technical requirements concerning information flows (ODPM, 2002).

Procedural risk: Procedural risks such as physical security and user errors (ODPM, 2002), could be depicted in the modelling of the e-Voting process and therefore either predicted or counter-measured in a way that the outcome of the process would not be endangered.

Fraud: Although fraud could be regarded as yet another procedural risk, in our research we choose to provide a separate reference to it and attempt to manage it. The identification of fraud opportunities and their allocation to specific process steps could function in a preventive way against the possibility of fraud in all the different forms that it may take (Watt, 2002). Hence this line of research would support preventive management of e-Voting fraud.

7. Legal accountability and procedural responsibility

Defining roles and responsibilities within the e-Voting process could provide a better understanding of who is responsible for doing what so that the election result is effectively and efficiently produced. This also includes the issue of staff training in the new procedures and the new systems. The taxonomy of legal accountabilities in the UK e-Voting context presented by Xenakis & Macintosh (2003b), provides a mapping of the different legal cases which could arise and indicates legal accountabilities per agent, a feature which may prove especially useful considering the multiplicity of agents involved in the delivery of e-Voting services and e-enabled elections (Fairweather and Rogerson, 2002). It relates procedural responsibility to legal accountability, therefore indicating cases where an agent is legally accountable for an outcome without actually being responsible for the action that produced it.

7.1 Continuity of the process re-design

The need to adapt to e-Voting technology advances to changing voter trends could be accommodated by the modelling of the process. BPR could also provide a system to measure the achievement of the redesign goals and benefits, therefore providing common standards of comparison and effectiveness of alternative e-Voting channels.

7.2 Providing better management

Identifying and effectively introducing e-Voting technology to the electoral process could provide better management. This is in line with the need for customisation of the voting technology to fit local needs (ODPM, 2002), and the need for criteria of effective introduction of e-Voting technology. Issues like voter education and transparency of operations could be benefited by providing a contractual view of the process allowing understanding of roles and interactivities (Glykas, 1994). Finally, re-design of the process could lead to process simplification, which is also a requirement in the application of e-Voting (Fairweather and Rogerson, 2002).

8. Conclusions

This research is being undertaken as part of a PhD aiming to provide a methodology for e-Voting management, modelling and analysis, based on BPR techniques. The result of this research to date has been to establish the key areas of electronic voting where the application of BPR methods and analysis tools could prove effective and provide efficiency gains. We can therefore identify the following potential benefits:

8.1 Providing a contractual view of electronic voting

A model of the contractual relationships in which the organisation participates should be in place before an attempt for BPR is carried out. These will contribute to the selection of the core election processes upon which analysis tools will be based. The focus should be on the identification of contracts that are critical for the election success. The notion of contractual relationships is broadly used by the UK civil service where independent agencies provide the central government with their services therefore developing a contract between them (HM Treasury, 1988). The identification of contracts will in turn help identify responsibilities and obligations among different agents deriving through their participation in contractual relationships. The multiplicity of the agents involved in the delivery of electronic voting forms part of the administrative related issues.

8.2 Defining responsibilities

When agencies participate in contractual relationships they undertake a set of responsibilities that are determined by the terms of the contract. Within an organization, responsibility relationships determine the type of the structural relationships between pairs of co-workers, whereas, a responsibility relationship between an external agent and an organization exists only for the duration of the specific contract. The notion of accountabilities is closely related to the identification of responsibilities. A person is held responsible by others when having an accountability, which will in turn create procedures even if not originally defined (Scherr, 1993). Once agent responsibilities have been identified they can subsequently be allocated along the e-Voting

process. This will be achieved by defining the agency relationships between the different collaborating parties in the e-Voting procedures, clearly demonstrating each agent's role and internal responsibilities.

9. Providing an object orientation process design element

Object orientation analysis deals with the issue of complexity. This is done based on the principals of abstraction and modularity (Glykas, 1994). Abstraction based on classification and generalization creates hierarchies of object classes, whereas aggregation hierarchies depict relationships of the aggregate classes and their component classes (Booch, 1991). Teams of objects interact to fulfil their responsibilities. The object client requests and receives a service by the object server within a given contract. This relationship could possibly enhance internal logistical support of the e-Voting management and the mapping of voting data exchange. The need for abstraction is evident in the case of e-Voting because of the high level of complexity involved in the process.

9.1 Representing organizational dynamics

In this instance the main issue is why should we provide process models. According to White (1992) process models serve to understand the reason justifying the process. Modelling can aid communication about the process and analyse it by determining the ways in which the process may be improved. In this way we can form a basis on which to specify systems support for the process. The organization's procedures and processes are examined so as to identify objectives, objects, activities, interactions and dependencies. Although no formal organisational structure has been identified in the e-Voting pilot cases this will probably emerge as a necessity for prospective scalable electronic elections.

9.2 Defining obligations

Obligations limit the choice of action, and therefore need to be fulfilled according to the undertaken responsibilities. Responsibility is 'for' something; obligation is to do something. Obligations are concerned with keeping things the way they are or changing them in relation to the responsibility held (Dobson, 1989). The determination of e-Voting agents and their responsibilities will include the specific identification of their procedural obligations. This aims to help manage the multiplicity of the agents involved in the delivery of e-Voting.

9.3 Specifying roles

Roles are related to agents who operate under an obligation to fulfil certain responsibilities. Simple actions are assigned to agents through roles. Processes are composed from the combination of these simple actions. Roles define an agent's state at any point in time. Agents rationally choose their next action according to the options associated with each specific role (Hirchseim, 1985). The modelling of e-Voting agent roles will serve the mapping of the tasks attributed to each agent. This aspect interacts with the allocation of procedural responsibilities but mainly aims at efficiency gains and better understanding of the process.

10. Defining the context of rules

The concept of business rules is related to the satisfaction of obligations constraining agents' actions. Rules are therefore constraints put on people by the organization on how they should act (Ould, 1992). Constraints are thereafter inherited to processes and activities either partially or in full. In the e-Voting context, business rules are substituted by the existing legal framework defining the election. During the pilot stage special legal provisions are taken for each pilot project. Similarly legislation varies according to different elections. We should therefore consider the legal framework as a dynamic factor to which e-Voting management should adjust accordingly.

In this paper we have identified the e-Voting issues, which can be addressed through the use of BPR methods and analysis tools. In doing, so we have mainly focused on the administrative side of e-Voting. Related future work includes the development of a methodology dedicated to the management of simultaneous, multiple channel delivery of electronic voting.

Reference

Ballinger, C. & Coleman, S. Elections and the Internet Some Issues Considered, Hansard Society (2001).

Booch, G. Object Oriented Design with Applications. CA: Benjamin Cummings, Redwood City (1991).

Butler-Cox Foundation. The Role of Information Technology in Transforming the Business: Management Summary, Report 79, (January 1991).

Coleman, S. et. Independent Commission on Alternative Voting Methods, Elections on the 21st Century: from paper ballot to e-Voting. Electoral Reform Society, (2002).

Davenport, T.H. Process Innovation: Reengineering Work Through Information,

Technology. Harvard Business School Press, Boston, MA, (1993).
Dobson, J.E. & McDermid, J.A. Security models and enterprise models. In Landwehr, C.E. (ed.) Database Security: Status and Prospects II, Elsevier Science, Amsterdam, (1989).
Electoral Commission. Modernising Elections A Strategic Evaluation Of the 2002 Electoral Pilot Schemes, (2002).
Electoral Commission. Pilot scheme evaluation Liverpool City Council 2 May 2002, (2002a).
Electoral Commission. Pilot scheme evaluation Sheffield City Council 2 May 2002, (2002b).
Electoral Commission. Pilot scheme evaluation Westminster City Council 2 May 2002, (2002c).
Electoral Commission. Pilot scheme evaluation Chester City Council 2 May 2002, (2002d).
Electoral Commission. Pilot scheme evaluation London Borough of Newham 2 May 2002, (2002e).
Electoral Commission. Pilot scheme evaluation Broxbourne Borough Council 2 May 2002, (2002f).
Electoral Commission. Local electoral pilot schemes 2003, Briefing, April 2003, (2003).
Fairweather, B. & Rogerson, S. Technical Options Report, De Montfort University, Leicester, (2002.).
Glykas, M. “Agent Relationship Morphism Analysis” PhD thesis, University of Cambridge, (1994).
Hammer, M. Reengineering The Corporation: A Manifesto for Business Revolution. N. Brealey Publishing, London, (1993).
Harrington, H.J. Business Process Improvement. McGraw-Hill, New York, NY, 1991.
Hirscheim, R.A. Office Automation: A Social and Organizational Perspective. Wiley Series in Information Systems, Chichester, (1985).
HM Government. In the service of democracy, a consultation paper on a policy for electronic democracy, (2002).
HM Treasury. Improving management in Government: The next steps. Efficiency Unit, HMSO, (1988).
Johansson, I. Ontological Investigations: An Inquiry into the Categories of Nature, Man and Society. Routledge, London, (1989).
IPI, Internet Policy Institute, Report on the national Workshop on Internet Voting: Issues and research agenda, (2001).
Klischewski, R., & Lenk, K. Understanding and Modelling flexibility in administrative processes. In Proceedings of EGOV 2002, Ed. Traunmuller R., and Lenk, K., (2002), pp.129-136.
Lenk,K. Business process reengineering in the public sector: opportunities and risks. In Taylor, J.A., Snellen I.Th.M. and Zuurmond, A. (eds). Beyond BPR in Public Administration: an institutional transformation in an information age, pp. 151-165, IOS Press, (1997).
ODPM. Office of the Deputy Prime Minister, Electoral Modernisation Pilots, Statement of requirements, (2002).
Ould, M.A. Process modelling with RADS. IOPener 1(5), (1992).
Pratchett, L. Reegineering UK local government: opportunities and prospects. In Taylor, J.A., Snellen I.Th.M. and Zuurmond, A. (eds). Beyond BPR in Public Administration: an institutional transformation in an information age, pp. 165-188, IOS Press, (1997).
Pratchett, L. The implementation of electronic voting in the UK. LGA Publications, the Local Government Association, (2002).
Scherr, A.L. A new approach to business processes. IBM Systems Journal 32(1), (1993).
Watt, B. Implementing Electronic Voting, A report addressing the legal issues by the implementation of electronic voting, University of Essex, (2002).
White, P. Modelling Processes in Organisations. IOPener 1(3), (1992).
Xenakis, A. and Macintosh. A., Using Knowledge management to improve transparency in e-Voting, proceedings of KMGOV 2003, Spinger, (2003).
Xenakis, A. and Macintosh, A., A Taxonomy of Legal Accountabilities in the UK e-Voting pilots, proceedings of DEXA, E-GOV 2003 Spinger, (2003b).
Xenakis, A. and Macintosh. A., Procedural security in electronic voting, to appear in the proceedings of the 37th Hawaii International Conference on System Sciences (HICSS 37), (2004).
Zuurmond, A. and Snellen I.Th.M. From Bureaucracy to infocracy: towards management through information architecture. In Taylor, J.A., Snellen I.Th.M. and Zuurmond, A. (eds). Beyond BPR in Public Administration: an institutional transformation in an information age, pp. 205-224, IOS Press, (1997).

