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Goverment and ICT Standards: An Electronic Voting Case Study

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ABSTRACT

This paper examines and illustrates the process of setting technical intercommunication standards through a case-study taken from the electronic voting industry. It begins by addressing the large number of types of standards and the many ways in which they are created. The tensions between the speed to market, stakeholder involvement, the mode of production and the legitimacy of a standard are explored. The modes of standards production are then presented in a linear model. The preceding discussion sets the context for a case which presents attempts to standardise the large number of competing electronic voting solutions. The importance of which actors back and influence a standard's development up to successful adoption is exposed. The vital role government can play in preventing a standards market failure is raised and recommendations are offered on how governments can improve their contributions to standardisation.

This paper presents a case study detailing several attempts to standardise aspects of electronic voting systems. This case is important not only due to the controversy surrounding the implementation of electronic voting systems but because it provides an interesting perspective on government intervention in the development of information and communication technology (ICT) standards. By taking a descriptive approach this paper does not aim to, in the positivist tradition, prove or disprove certain theoretical approaches to ICT standards.[1]

Before presenting the case this paper will use the first section to set the theoretical context. The current literature will be examined and used to provide a simple framework to help clarify the presentation of the case delivered in the second section. The paper will then conclude with an examination of the case study against the theory discussed along with recommendations which arise from this analysis.

KEYWORDS

Electronic voting

Standards

Consortia

ICTs

e-government

THE THEORETICAL CONTEXT OF STANDARDS

Standards are used in a vast range of activities but the focus of this exploration will be ICT-based. For the purposes of this paper the author will define a standard as "a set of technical specifications that may be adhered to by a producer, either tacitly or as a result of a formal agreement" (David

and Rothwell, 1996), a definition used by the UK government's own centre for ICTs, CCTA[2] (CCTA, 1994). Within this definition fall a number of variables by which standards may differ and these will be addressed in turn.

Standards: a multitude of types and uses

This section aims to provide sufficient background on technical standards to enhance the reader's contextualisation and understanding of the subsequent case. David identifies three key types of standards (David, 1995). These are reference standards (e.g. the International Committee on Weights and Measures' platinum-iridium cylinder that defines one kilogram), minimum quality standards (e.g. BS 6807, the British fire safety standard for mattress ignitability) and interface or compatibility standards (e.g. the 'Really Simple Syndication' standard for syndicating a website's headlines to other sites).

The time taken in the complex negotiations required to agree on standards, along with the subsequent adoption process standards-users must undergo, has resulted in standards tending to lag behind technological innovation. This lag can create a gap between the dated technologies defined in standards and the technology currently available. To redress this technological gap two complementary types of standards need to be super-imposed across David's three. The first of these types are meta-standards, which define a standard way of describing standards. An excellent example is eXtensible Markup Language (XML), a standardised method of defining structured data languages, such as those for building web pages. The second complementary type are forward or anticipatory standards which predefine areas which do not yet exist as usable technologies. So, for example, the IEEE 802.11 standard for wireless networking (commonly known as WiFi) has predefined levels of definition which anticipates future security and performance gains. Both forward and meta standards aim to create enough certainty for new markets to emerge but usually at the expense of detailed and precise specifications (Hawkins, 1991). It is important to note that forward and meta standards can be reference, minimum quality or interface standards, hence they complement David's typology.

The split between market (de facto) and organisational (de jure) forces is a simplistic way of modelling standards. There are other, more complex, models

The literature often typifies standards as being in tension between forces of freedom, which can allow diversity and creativity for evolution, and forces of order which can offer efficiency and stability benefits. This balance shifts over time resulting in periods of relative freedom interspersing times of standards-induced order (David and Rothwell, 1996). That is, with some types of standards, a design paradigm embodied in a standard allows, for a period, economies of scale to emerge providing firms with a chance to reap profits from the standardised innovation in question (Teece, 1986).

Another way of approaching the polarisation between freedom and order is to model standards as being produced by a variety of means which can be divided between *de jure* and *de facto* (CCTA, 1994; David, 1995). De jure standards are typically created by independent institutions specifically formed for the purpose of developing standards, for example the International Telecommunications Union. One of the benefits of institutional standards-setting is their providing very specific rules and procedures for developing consensus whilst ensuring that a broad set of stakeholders are engaged.

De facto standards, by emerging from market forces, eschew institutional processes whilst tending to have commercial interests tied to their development. For example, Windows operating on an Intel microprocessor is a de facto personal computer platform standard due to its market dominance; no independent body specifies or verifies it as a standard. Market driven de facto standards tend to have a faster time to market as it is usually through competition in the marketplace itself that

the standard emerges. Unfortunately this speed to market is often to the detriment of stakeholder involvement. This is due to consulting stakeholders being seen as time-consuming, thus when speed to market is a motivating factor, 'slow' procedures tend to be avoided.

However, the split between market (de facto) and organisational (de jure) forces is a simplistic way of modelling standards. There are other, more complex, models such as the four-part taxonomy of how standards are developed proposed by David. In this richer model the first two types of standard are generally de facto whilst the latter two types are usually de jure:

A. Unsponsored standards, with no identified originator holding a proprietary interest or sponsor organisation but still existing in a documented format which is publicly available.
B. Sponsored standards, where proprietary interests are engaged through sponsoring or inducing others to adopt the standard.
C. Standards agreements produced by voluntary standards-writing organisations such as the World Wide Web Consortium (W3C).
D. Mandated standards which emerge from government and its agencies and have some legal authority.
(David, 1995)

Within the ICT field the majority of standards fall into categories 'B' and 'C', though there is a small, but growing, amount of mandated regulatory standards activity. As governments, through e-government and e-democracy initiatives, become more proactive in their use of ICTs the number of mandated ICT standards will continue to grow. For example, policy targets are encouraging the use of smart cards and so standards defining the physical formats and software interfaces for the cards are being developed by governments internationally (Davies, 2004).

David's typology presents four modes in which standards may be developed. To explore the full range of processes used to produce standards one can take a linear approach. With a linear approach one views the means of standards production as existing along a range between the two extremes of market forces and institutions. Along this range lie a variety of modes for developing standards. One of the most common modes, and the most relevant to the case which will be presented, is the consortium.

Consortia are a pragmatic compromise between the perceived strengths and weaknesses of the market-based and institutional standardisation solutions. Numerous standards consortia have been rapidly created due to frustrations with the frequently glacial pace of institutional standards development paired with concerns over leaving standards to purely market forces (Besen, 1995). Sometimes created to champion a consensus rejected in another forum, consortia are a form of competition with existing standards organisations which can force an acceleration of procedures (Besen, 1995). For example, IBM, BEA, SAP and Microsoft chose the OASIS consortium to standardise business processes, in lieu of an existing World Wide Web Consortium committee working on the same task (LaMonica, 2003). As consortia provide an alternative path to be dangled before more formal institutions when procedures are lagging, they threaten a race to the bottom of ever more rapidly published standards with diminishing quality and user participation (David and Shurmer, 1996). Additionally, as new entrants to the 'standards market', consortia risk diverting resources from existing standards institutions, thereby diminishing the economies of scale established institutions may experience in developing new standards. It is not only the standards institutions' economies of scale which may suffer when consortia increase competition in the market for developing standards. The broader community, whose interests are intertwined with the development of standards, is disadvantaged when consortia often tend to bypass the public interest safe-guards which more formalised institutions regard as central to their procedures.

The explosion in the number of standards bodies raises issues over which bodies can legitimately claim to have developed definitive standards. As it becomes unclear which standard will be authoritative, tracking the numerous new standards initiatives (which may or may not result in widely accepted standards) becomes increasingly troublesome (Alexander, 1995; Besen, 1995).

Because these various standards must be brought into conformity and duplication of effort becomes ever more likely then, participants also suffer an increase in co-ordination costs (Besen, 1995). These increased co-ordination costs as well as the perceived lack of influence single participants can wield has led to companies often being reluctant to get involved in standards committees.

David and Shurmer raise concerns over the 'privatisation' of standards by consortia when standards were formerly public goods created by national and international cooperation. They question whether private consortia have the commitment to support and nurture their standards once they have been established in the marketplace, particularly when consortium participants are direct competitors (David and Shurmer, 1996). Consortia's uncertain commitment to their standards, as well as the growing number of competing standards bodies (many of which are consortia), are recognised by David and Shurmer as potentially problematic. They propose that these problems could be minimised through closer collaboration between consortia and formal standards organisations. Such collaborations can provide faster development times through the consortia and greater legitimacy through the established institutions. Examples of this approach in industry do already exist, such as with Netscape's JavaScript becoming formally standardised into ECMAScript. Unfortunately however, user and other stakeholders' participation have still not been satisfactorily addressed in situations where predefined technologies are brought to formal standards bodies. Issues of restricted participation arise partly due to the fact that contributing consortia and firms want to retain control, particularly when issues of intellectual property arise.

When discussing restricted participation the concept of 'user coalitions' is a helpful addition to the discourse (Foray, 1995). In an attempt to overcome limitations in their levels of participation in a standardisation process, users can club together to use their aggregated influence in making their voices heard within existing standardisation processes. User coalitions can also apply their united voices in encouraging suppliers to adopt standards. Yet, in many cases users, even clubbed together, are too small to be heard unless specific efforts are made by standards bodies to connect with the standards' potential users. It is when those defining the standards become disconnected from the stakeholders, such as users, that defined processes mandating consultative periods, common in standards institutions, can play an important role.

But why involve users at all, as it is manufacturers who usually implement technical standards? If one extends Needham's work on local government consultation (Needham, 2002) to the world of standards then reasons for user participation fall into pragmatic and principled categories. The pragmatic reasons encompass the desire to ensure broad adoption by aligning the standard with users' needs. The principled reasons include the noble desire for organisations to be creating standards that address and benefit all stakeholders and not a small subset of manufacturers, thereby increasing the organisations' legitimacy. Another perspective, emerging from the environmental standards literature, is that stakeholders have a direct interest in the outcome of standards and thus should be instrumental in deciding what is acceptable risk and what is not (Leiss, 1995). Within an ICT setting the level of risk could be, for example, the level of backwards compatibility with older technologies or the cross-platform compatibility with competing products a standard should offer.

Naemura classifies users into 7 layers which he proposes as being analogous with the layers of the Open Systems Interconnection Reference Model.[3] In Naemura's model "an entity in layer 'n' makes use of a service provided by an entity in layer 'n-1'" (Naemura, 1995).

This user typology highlights the diversi-

Table 1 Layered model of user types (Naemura, 1995)

Layer	
1	End-users
2	Corporate system managers
3	System integrators/network operators
4	Component/systems implementers
5	Functional standard providers
6	Base standard providers
7	Underlying technologies (e.g. semiconductors)

ty of users that must be addressed in the consultative periods of standards development. Not only is the range of users problematic but so is the number of users. The end result is that engaging even a representative subset proves challenging since reaching enough users to inform them of the process underway can be logistically difficult. If successfully contacted, users must weigh whether it is worth their while committing resources to the process. In so doing, several questions arise. Will their voice have any influence? Will the proposed standard be adopted or are competing options more likely? Could the standard be obsolete by the time it is finished? Assuming rationality, a good knowledge of the standards 'game' is needed by prospective standards users before answers can be formulated. As few users may have the knowledge to answer these questions the field of qualified potential participants is further limited (David and Shurmer, 1996). So the wide range of potential users and stakeholders make meaningful participation a difficult process. By attempting to undertake the challenging process of encouraging participation, formal standard institutions tend to have the slower standards production processes which have motivated firms to create consortia.

To summarise, standards are technical specifications which can be used for several purposes such as compatibility or minimum quality. The means of standards production range from market forces (de facto) to formal institutions (de jure) with consortia existing somewhere between these two (see Figure 1). Naturally, there are strengths and weaknesses to each of these modes but they all, to a greater or lesser extent, interact with stakeholders. Subsequently, the reasons for participation in standards processes were discussed and a seven layer typology of users was introduced. Before examining the e-voting case study, an analysis of the economic role of standards will be presented.

The Economic Perspectives

The economic approach complements the models presented in the previous section. This section moves from the types of standards and the means in which they are produced to the economic impacts of standards. The dominant economic view of standards is based on information economics which typifies standards as non-rival commodities lacking super-additivity. In other words, having the same piece of information or standard twice does not increase its value, in fact the value may actually decline in the case of standards. This is unlike the idea of redundancy (having the same information more than once) which information theorists such as Shannon (Shannon, 1948) have shown to be of value in communications.

A greater number of standards tend to not be worth more than one standard, but a single standard can offer benefits through bandwagon effects. For example, by defining the containers used to transport cargo, a standards' introduction can reduce transaction costs between economic agents. As the benefits from the standardisation accrue it becomes worthwhile for other economic agents to adopt the standard and so the bandwagon begins rolling. Adopting the standard allows economic agents to also access, in the same more efficient manner enabled by the standard, the growing sub-market of agents who have adopted the standard (David, 1995). Many types of

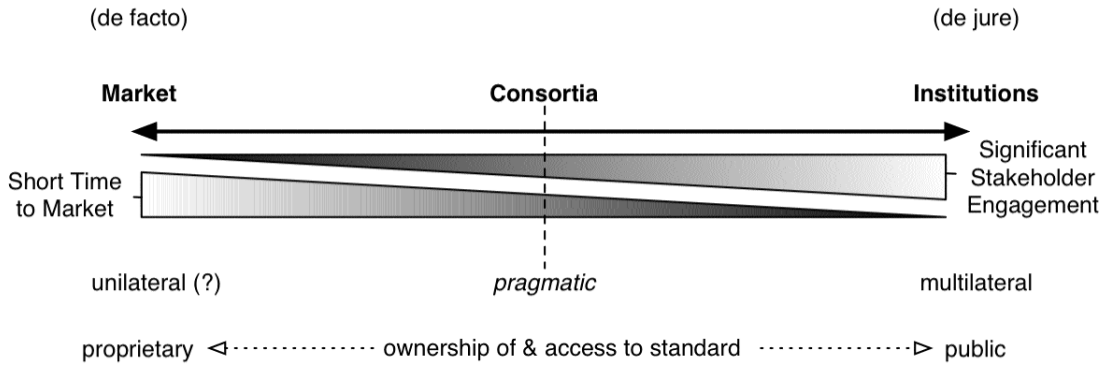

Figure 1 The range of modes of producing stnadards and the properties by which they vary

Table 2 Types of lock-in and associated switching costs from (Shapiro and Varian, 1999)

Type of Lock-In	Switching Costs
Contraction commitments	Compensatory or liquidated damages.
Durable purchases	Replacement of equipment; tends to decline as durable ages.
Brand-specific training	Learning a new system, both direct costs & lost productivity; tends to rise over time.
Information & databases	Converting data to a new format; tends to rise over time as collection grows.
Specialised suppliers	Funding of new supplier; may rise over time if capabilities are hard to find/maintain.
Search costs	Combined buyer & seller search costs; includes learning about quality of alternatives.
Loyalty programs	Any lost benefits from incumbent supplier, plus possible need to rebuild cumulative use.

standards offer such network externalities but the ICT industry has particularly benefited from leveraging the positive feedback of bandwagon effects.

The positive feedback processes common in the ICT industry can be illustrated by Real[4] and their multimedia player software. Real distribute their player software freely over the Internet because the more users who install the player (and so are able to decode the Real format), the more likely content production firms will be to use the format, leading to a de facto standard. Additionally, the more attractive content available in the Real format, the more users will be motivated to download the application, resulting in a *virtuous cycle*. Once 'caught' in the web of network interactions firms are motivated to keep their users locked-in and collect as much profit as possible by maximising the switching costs for the user to move to another network of compatibility.

Lock-in is where technology providers, often through proprietary file formats, create barriers to users switching supplier. Once they are locked-in users are likely to experience price rises. Shapiro and Varian identify the types of lock-in and the associated switching costs (see Table 2). From the table it is clear that some switching costs emerge from the very nature and implementations of specific technologies. The table also presents strategies firms can use to enhance these existing forms of lock-in. Alternatively, firms can create new switching costs altogether, such as through the creation of 'loyalty programs'. Lock-in can have economic and social benefits but the risk is that mandated standards (such as through legislation) can bring about premature lock-in thereby freezing technical development and reducing the potential efficiency gains the standard might deliver (David and Steinmueller, 1996).

Lock-in is one of several key motivators for firms trying to create standards. The key economic incentives for standardisation, according to Hawkins, are: cost control through variety reduction; harmonisation to allow network compatibility; intelligence by using standardisation procedures to evaluate the state of a technology; creating new products and categories by building a critical mass for the base platform and finally market positioning, whereby networked externalities are leveraged to support a firms' planned innovation and marketing activities (Hawkins, 1997). But it is lock-in and the virtuous cycle which have grabbed the most attention for hopeful entrepreneurs in the ICT industry and their long-suffering users.

One means by which users have tried to minimise lock-in has been by requiring 'open standards' compliance from providers. While heralded as the end of users' technological lock-in, this has never been truly achieved. Part of the problem has been disagreement over whether open standards truly mean independence from any one vendor's products. For example,

the Windows programming interfaces are presented as being open by Microsoft as some parties can examine the specification. However, Microsoft retains control over the interfaces' design and implementation and so can change the standard when it pleases. Government agencies put considerable faith in the open standards concept to prevent specific suppliers 'owning' departments through the technological hold they have on the systems.

Open standards are usually de jure standards where any provider can read and implement the specifications. Thus, any supplier can provide products that meet the standard thereby potentially enabling broad competition on a level playing field. But there have been difficulties gaining industry and user acceptance for specific instances of open standards. Because open standards define technologies in publicly available documents they reduce the barriers to new competitors entering a market (Tassey, 1995). As a result, suppliers keen to defend existing market shares make enforcing supplier adherence to such standards problematic (Hawkins, 1993).

The most common strategy taken by firms to undermine adherence to open standards is known as 'super-setting'. Super-setting or 'embracing and extending' open standards is when firms claim adherence to a standard whilst providing extensions which users come to rely on but are only available from the single commercial source. As the extra features are not defined in the standard, compatibility is undermined and the standard's credibility and positive network externalities are threatened whilst the supplier's lock-in increases (David and Steinmueller, 1996). An excellent example is the Structured Query Language (SQL) standard used for programming databases. Whilst a standard defined by major standards bodies (American National Standards Institute and the International Organisation for Standardisation), most database suppliers (including Oracle, Microsoft and MySQL) provide proprietary extensions to SQL which offer greater flexibility and performance than the standardised version of SQL can provide. As developers begin to rely on these extensions they inevitably become dependent on a specific supplier, as the extensions are only available on that supplier's database product. SQL has been supersetted to successfully lock users in, despite the products being notionally built on an open standard.

The example of SQL shows how a firm can be successful in leveraging an open standard to its own profit, but from a position of market dominance there are few reasons an ICT producer would be willing to build its business on an open standard. Adopting open standards risk a firm's technological future by accepting lower barriers to entry. It also limits a firm's opportunities for cranking up its users' switching costs.

Because it is not in the interests of dominant ICT suppliers to adopt open standards, it is primarily through proactive procurement policies that producers have been led into adopting open standards. Government has a particularly important role to play in standardisation as a major user and a representative of a broad user constituency. Governments also have the ability to step back and provide strategic overviews of what should be standardised when firms are lost in the detail of feature comparisons and the cut and thrust of competition in the market. That said, governments have historically had a predilection for standards peculiar to their needs, either because they convince themselves that their requirements are indeed unique or that a local firm needs support at the expense of a more globally accepted standard (Repussard, 1995; David and Steinmueller, 1996). Hence governments must take care when mandating ICT standards.

Governments also have the ability to step back and provide strategic overviews of what should be standardised

The alternative to the information economics view of standards is to portray them as possessing the properties associated with *pure public goods*. With such a perspective standards are examined for the benefit they can offer to society at large. Within the technological sphere benefits offered to citizens by standards include reduced cost, wider access to con-

tent and ease of use. Too many competing standards result in what the static theory of standardisation would regard as a market failure. Market failure in this context is where there is insufficient order for an efficient market. An excellent example is the 'Colour TV War' where consumers were forced to bear the costs of upgrading their TV sets whilst incompatible colour broadcast standards battled for dominance in post-war North America and Europe (Donnelly; Wikipedia, 2004). In the case of colour televisions the results of the market failure were more costly sets, consumer confusion and a limited access to content due to the competing broadcast formats.

An alternative outcome to market failure is where there are a small number of potentially successful standards but network externalities result in a bandwagon forming around a single standard. The result is that the remaining communities of users, who adopted the other standards, become 'orphaned' from the mainstream. So whilst ISDN telephony seemed desirable at one point, it is now a barrier to those wishing to upgrade to DSL broadband services leaving users with expensive and potentially useless ISDN hardware. It can be argued that too rapacious a market for de facto standards or insufficient order and clarity can require government intervention to push for more socially and economically desirable long-term outcomes (David, 1995).

As has been shown, ICT standards can be examined, from both an information economics and a public goods perspective. These perspectives show how standards can provide huge recurring benefits to suppliers by locking users into networks which can exhibit positive externalities. These approaches also show how government plays a complex role in the formation and use of standards which resists formalisation. Undeniably, the economic explanations are rather too neat. As Hawkins identifies, they fail to integrate innovation and technical change. Furthermore, the complexity of public sector involvement is extremely difficult to formalise (Hawkins, 1991). Nevertheless, with such problems duly noted, we can proceed with presenting the case, using the theory introduced to provide context and structure.

CASE STUDY: AN ELECTRONIC VOTING STANDARD

Electronic voting is seen as a huge new market opportunity which a number of start-up and established firms are trying to capture. Electronic voting includes several distinct applications:

- Direct Recording Electronic (DRE)[5] voting which consists of kiosk-type hardware in the polling station.
- Remote Electronic Voting[6] in which voters use computers at work or home to mark an 'electronic ballot' and return it over the Internet to a central server.
- Electronic Counting in which the vote is marked on a paper or card ballot and which is then counted by opto-electrical hardware.
  (The Independent Commission on Alternative Voting Methods, 2002)

Vital to all types of voting is the authentication of voters where people wanting to vote are verified as indeed being allowed to vote and not already having voted. There is a strong trend towards computerising and centralising the electoral roll which allows such authentication to be efficiently carried out (Office of the Deputy Prime Minister, 2004). Computerised electoral rolls should be considered a part of the electronic voting market.

Current UK electoral law prevents the use of electronic voting in full national elections but permits electronic voting in pilots monitored by the independent Electoral Commission. Robin Cook MP, when Leader of the House of Commons, very publicly committed the UK to being the first country in the world to use the Internet for voting (BBC, 2002). This has created a strong imperative for developing and testing electronic voting systems in a variety of configurations.

Though much of the standards activity in this case was driven by the UK government, the firms leading the electronic voting market are mostly US-based. Many of these specialist firms were having financial troubles until the debacle of the 2000 US Presidential election provided a massive boost in funding for upgrading voting systems across the USA. The leading electron-

ic voting-specific firms during the period of this case-study (2000–2003) were Diebold Election Systems, Election.com,[7] Election Services & Software, PowerVote, SafeVote, Sequoia Voting Systems and VoteHere who all claimed to provide complete voting, counting and electoral roll services. Several generalist multi-national ICT firms such as BT, EDS, Unisys and Accenture were also attempting to gain a foothold in the market. There were also a number of small specialist outfits focussing on non-governmental voting (such as for shareholder elections) and electronic counting or electoral roll only suppliers. This was a fractured, nascent market where each supplier offered a unique proprietary solution, often built on custom hardware. Suppliers, by only selling proprietary offerings, were trying hard to lock-in electoral constituencies thereby ensuring their long-term financial security through maintenance and support contracts.

Electronic voting has been experimented with for some time, particular through the touch-tone and interactive cable TV systems (e.g. Cross, 1998). The United States, due to the high frequency of elections and the large number of contests run simultaneously, has had particular incentives to automate voting and counting, a problem even Edison worked on in the late 19th century (Wilhelm, 2000, pp1). Punch card, mechanical lever and more recently optical systems have all been used to ease the administrative burden of elections. Most nations using these technologies created standards of accuracy and reliability which the suppliers of machinery had to meet. These provided some level of assurance in election results for voters and candidates. However there was little to protect authorities from the high costs of being locked into maintenance agreements for proprietary machinery.

With the advent of ICTs, digital technologies opened the field for a new phase of development in the evolution of automating elections. Previous standards for accuracy and reliability were obsolete when faced with computer code and network connections. Additionally, some authorities saw the opportunity to avoid being locked-in by suppliers on this new round of procurement for digital voting systems. As the electronic voting market began to heat up in 2000 the field was open for new voting standards to be developed.

An initial standardisation attempt was made, in February 2000, through the creation of the Internet Voting Technology Alliance (IVTA). IVTA aimed to become an information resource for promoting "public confidence in Internet voting" and a forum for developing voluntary standards. This was pitched in press releases as "a first step in the self regulation of the Internet voting industry." (IVTA, 2000a) The use of Internet Engineering Task Force (IETF) standards development rules was proposed for bootstrapping IVTA's own standards production process. However, no agreement on what the standards would define was ever reached (IVTA, 2000b). At the initial, and only, meeting of IVTA most major electronic voting firms were present as well as influential independent consultants, several NGOs and major firms with interests in the voting process. Despite an impressive array of organizations and 33 individuals at the founding meeting, activity on the alliance's mailing list was restricted to a small number of actors – 16, with only 8 people posting more than 2 emails, some of whom weren't present at the meeting. Dr Ed Gerck, the IVTA chairman, posted 56% of the 130 non-spam emails on the list and with his fellow SafeVote employee, Eva Waskell, accounted for 65% of the list's emails.[8] In fact it appeared that SafeVote were orchestrating the entire organization as Waskell was appointed secretary and the company had offered their 'independent' newsletter, *The Bell*, as the official publication of IVTA. While no clear event can be identified for causing its demise, 11th September 2001 marks the last email to the working group list, in a response to a previous topic. Since then no announcements have been made and the IVTA site has not been updated. The inactivity could lead one to conclude that the IVTA had ended without meeting again or even agreeing what it would standardize. Nevertheless, in a private email sent March 2004, the IVTA chairman, Dr Gerck, stated that "the IVTA [has not] ended [its] potential contributions."

On 29th March 2001 the OASIS (Organisation for the Advancement of Structured Information Standards) e-business standards consortium announced an Election and Voter Services Technical

Committee. This committee, proposed by Election.com, Microsoft and Accenture, would develop an electronic voting standard using XML.[9] This caused a small ripple in the electronic voting world as Accenture was known to have an investment of at least $10 million in Election.com and a very close relationship with Microsoft. Furthermore, few of the obvious electronic voting stakeholders were directly asked to participate and so the announcement was left to trickle around as contacts forwarded the press release. Election.com's prominent participation in the OASIS committee seemed to be a clear snub, by a leading supplier, to the IVTA which Election.com had also been involved with.

A key IVTA member questioned the validity of the OASIS committee choosing to use XML for its technical standard. In a private email (May 2001) the IVTA member wrote:

> "This initiative is not about an Internet voting standard but about a XML schema for some messages in voting systems that use XML. Besides this restricted scope, the use of XML is, however, not very helpful for Internet voting because it does make the messages a lot bulkier in an environment which is expected to have high peak traffic."

Essentially, the argument was that using XML would result in relatively bulky messages which the IVTA member deemed inappropriate for use in high-traffic applications such as electronic voting. The IVTA member also wondered whether the OASIS committee would be developing a reference standard defining best practice, as many experts felt was needed, or just a limited compatibility specification to ensure competing systems could 'talk to each other'. A reference standard would define precisely how a secure, reliable and accurate electronic voting system would be built and run. A compatibility specification, however, would only define how competing systems would interconnect, omitting to specify the important matters of how the systems would provide trustworthy results. As will be shown, OASIS did mostly develop the latter rather than the former.

The UK government's electronic voting pilots do require compliance with the standard

The correspondent with ties to the IVTA also characterised the OASIS initiative as a way "to insert some companies in[to] the voting dialogue".[10] In other words, some members of the electronic voting community felt that Microsoft and Accenture were using Election.com and the OASIS committee to raise awareness of their products and services in the e-voting market, a market where they previously had had little involvement. Additionally, concerns were raised over the selection of OASIS for developing an electronic voting standard. In particular several committee members were worried that the OASIS membership fees would restrict participation and give the appearance of a 'close committee', the minutes noting that:

> Several members expressed concerns that the imposition of a fee to become an OASIS member may be a barrier to entry for some not-for-profit groups and may give the appearance of being a close committee for that reason. (OASIS, 2001d)

OASIS is a privately funded consortium which requires annual fees of at least $250 for individuals or firms to participate (OASIS, 2003a) and trumpets its "lightweight, open process" with very informal participation procedures and an industry focus (OASIS, 2003b). Perhaps those critical of the OASIS initiative felt that more established Internet standardisation bodies with greater legitimacy, such as the IETF, would have been significantly less open to launching the committee with such a small and close-knit group of proposers.

Despite reservations over the OASIS committee amongst some in the electronic voting community, the standardisation process moved forward relatively productively. Rapid progress was facilitated by the initial announcement including a detailed brief specifying the rationale, scope and timetable for the standardisation process (OASIS, 2001d). Furthermore,

Election.com had a prototypical standard already developed and implemented internally, the details of which were shared with the committee (McGilvray, 2001). In August 2001 Gregg McGilvray, Election.com's CTO and the committee's chairman, stepped down to allow a vendor-neutral individual to take the lead as McGilvray's chairmanship had been identified as a barrier to bringing more participants into the committee (OASIS, 2001a). The members allowed to vote[11] were quick to confirm the only nomination, Anwar Choudhury of the UK Office of the e-Envoy, as Chairman. This marked the beginning of the UK government's heavy involvement in the committee (Ryan, 2001).

Meetings, teleconferences and email discussions progressed at a steady pace with much of the activity hosted and jump-started by staff and consultants from the Office of the e-Envoy (OeE). This was due to pressure being put on OeE to ensure rapid delivery of electronic voting whilst maintaining the belief that implementation had to be done with a standard in place that would prevent their being locked into any one supplier. Unlike the United States, with decentralised procurement of voting systems, UK electoral matters are highly centralised and it was likely that OeE would be making a selection for a system in one national decision. A way to avoid becoming beholden to one producer was to ensure their replaceability by competitors through a compatibility standard.

Yet this standard was, despite a preponderance of US/UK participants, intended to be international. Several attempts were made to engage governments and suppliers from across Europe and Australia, with limited success (OASIS, 2001c). Nevertheless, observers from a broad range of nations and backgrounds (academic, commercial, NGO) did participate intermittently which ensured that enough flexibility was included in the standard to support variations such as the UK's lack of anonymous voting compared to most other democracies' insistence on anonyminity. The issue of voter anonyminity did cause tensions (OASIS, 2001b) as many participants felt that the standard should embody best practice for elections, which includes secret ballots. But OeE staff pointed out that they wouldn't be committing significant resources to developing a standard that couldn't be used under British law. Similarly, due to the unique proprietary nature of each vendor's security system (which were not open for inspection), the standard did not require any security mechanisms but suggested a theoretical basis for one. Only through such compromises, was a consensus achieved and the standard drafted.

The ensuing flexibility resulted in a standard where it was virtually impossible to test a system for compliance. The standard's adaptability stemmed from the large number of optional fields it defined. In theory the standard could allow communication between counting, voting and electoral roll systems from different suppliers. But such intercommunication could only occur if suppliers all agreed to use the same optional fields in the schema for each protocol. If one electronic voting system depended on an optional field not used by a competitor's then interoperability would fail. The minutes of the OASIS committee's meeting after the approval of version 3 of the standard recorded that:

> "It was agreed that in most cases '[the standard] does not guarantee interoperability'. [A consultant for OeE] added that interfaces are proprietary, and security solutions are never uniform. These issues fall under 'best practice guidelines'. The [committee] needs [to] examine if there are any interface points missing in EML, and whether the standards which are being created are for the right interfaces." (OASIS, 2003c)

So, in practice (as the vendors admitted), the standard did not provide interconnection. In other words, only through vendor co-operation, the primary objective of developing standards in the first place, could the OASIS e-voting standard be useful. It would seem that another standard would have to be negotiated to make the existing standard practical!

It is worth noting that while many participants made contributions, the specifications were primarily written by a very small sub-group of members using relatively technical language. Due to the dense technical jargon in the specifications, which uninvolved members were happy to assume had been correctly drafted, specifications

were invariably accepted with unanimous votes. There is however, evidence from the director of a supplier to the UK pilots that the process was perceived as being fair.

This director, who joined and participated in the OASIS process after observation for this case had ended, said in October 2003:[12]

> "I just feel like the EML standard no longer favours any specific suppliers... Everyone gets to speak and it's all being run in what I would describe as a fairly fair fashion."

Whilst at least some members of the OASIS committee felt that the process was fair, the process for non-members was rather unstructured. Even though there was a period for public comments before the vote on whether to accept the standard, the participation process was informal, involving emailing contacts for feedback and encouraging others to do the same (Borras, 2002). With such informal recruitment activity what was the main incentive for participation? Perhaps it was the implicit threat from OeE that a failure to meet this standard would exclude suppliers from winning a slice of the pie in the UK's race to get voting online. The more suppliers could influence the standard to meet their existing technologies, the less challenging it would be for them to meet OeE's requirements.

Version 1 was voted for by a much more diverse group of members from those that voted for a new chairman eight months previously. Subsequently the standard is now at version 3, but supplier adoption is unclear at the time of writing (June 2004). The UK government's electronic voting pilots do require compliance with the standard (Office of the Deputy Prime Minister, 2002 section 11), yet suppliers and monitoring departments both seem unaware of the standard (Kitcat, 2003). On 24th February 2003 version 3 of the Election and Voter Services Standard including the definition of Election Markup Language for interconnection, was adopted by the OASIS consortium whilst plans were already in place for subsequent versions to be developed (Ahmed, 2003). Until test implementations of the standard from three separate countries have been proven and documented the standard will not be formally adopted by OASIS (OASIS, 2002), at the time of writing these tests were still pending. However, in July 2002, the Institute of Electrical and Electronics Engineers (IEEE) began preliminary work on a committee for a voting equipment data interchange standard (IEEE, 2002) as an extension to a long running IEEE development process for a electronic voting equipment evaluation standard (IEEE, 2004). This process, led by representatives from the supplier Election Systems & Software (who were not involved in the OASIS committee), by exploring interoperability issues appeared to be a challenge to the EML Standard. However, OASIS and OeE have been trying hard to liaise with the IEEE to prevent duplication of effort (OASIS, 2003c).

CONCLUSIONS

The first initiative from IVTA was too far on the market-driven axis, threatening a de facto standard led by the proprietary interests of SafeVote. The OASIS standard, while a clearly commercial consortium activity, had the additional legitimacy of being part of an established standards organisation. Suppliers could support the OASIS standard as it was clearly only aimed to define an interface for intercommunication which didn't threaten their proprietary technologies. Furthermore, an interface standard addressed the needs being voiced by the suppliers' key potential customers in government, further motivating supplier participation.

Another initiative similar to the IVTA effort began to emerge through IEEE, clearly vendor-led and the type of standard to be created was left semi-obscure with the standard's web site providing little detail. However, the weight of an eminent standards organisation such as the IEEE may improve the committee's chances of recruiting support. Nevertheless, major suppliers such as Accenture, VoteHere and several governments were, for the foreseeable future, committed to the OASIS process.

While the literature introduced in the first section of this paper highlighted the range of users standards can address, the OASIS process never clearly defined who the users of their standard would actually

be. It could be argued that the users were the suppliers whose systems would need to implement the standard, yet a strong case can also be made that governments were the leading users as it was only through their requirement for a standard in procurement policies that would force its implementation. Other possible users might have been electoral administrators at local government level or the voters themselves. Whilst the existence and needs of each of these groups were acknowledged in use case diagrams developed during the standardisation process, no formal efforts were made to contact voters or electoral administrators until the standard was past version 1. Serious vendor involvement initially only came from Election.com until a change in chairman when VoteHere became actively involved. Other organisations such as the International Foundation for Election Systems and the Voting Integrity Project who were involved from an early stage could be argued as having been representative of a wider constituency, however neither they nor the committee performed formal consultations which would have been obligatory in more established standards institutions. An argument OeE would have made to support the approach taken is the necessity to gain momentum before stakeholders would commit time and effort, and also the time imperative to getting a standard ready for the UK's tough electronic voting timetable which meant OeE couldn't wait for others to join in.

The role of the UK government was key to the successful development of the OASIS standard. Only through OeE's explicitly vendor-neutral leadership did others feel confident in participating and it was through OeE's ability to leverage its contacts that European governments began to take an interest in the standard. The standard was given legitimacy (which was otherwise lacking through use of a commercial consortium as backer and the standard's initial proposal by a cosy set of commercial actors) through OeE's involvement and power in their explicit desire to mandate implementation of the standard in future electronic voting pilots.

By throwing their weight behind the OASIS process, OeE tried to prevent a standards market failure either through a lack of standardisation as suppliers focussed on pushing their proprietary solutions or through a divergent set of standards representing competing interests resulting in uncertainty for buyers about which network to get locked into. OeE recognised the dangers of lock-in, especially given the historically centralised nature of electoral matters in the UK, and thus promoted an interconnection standard that allowed suppliers to maintain their proprietary market differentiators whilst not trapping the government into a proprietary virtuous (for the supplier) cycle. But due to the complex nature of providing secure, anonymous and yet auditable electronic voting compromises were made that reduced the standard's value for interconnection. This may have been due to suppliers trying to limit the impact the standard had on their businesses either by handicapping it in development or by hobbling it in the tests undertaken during the 2003 pilots in the UK. However, the reduced compatibility may also have been as a result of the OASIS process' late start. By the time the OASIS committee began work suppliers had already built and invested in proprietary (and sometimes patent-protected) solutions which they were unwilling to open or abandon. Perhaps a better understanding of innovation and entrepreneurship processes would have resulted in a more timely initiation of the standardisation process.

MANAGERIAL RECOMMENDATIONS

The market has seen standards initiatives across the means of production spectrum from IVTA at the market end to IEEE at the institutional extreme with the OASIS consortium placed centrally. A government department has been relatively proactive in preventing a standards market failure and thus trying to avoid lock-in. However, the success of the OASIS standard in preventing lock-in and being adopted against other initiatives is not yet certain. Nevertheless, several recommendations can be made: Governments should consider being more forward-looking and proactive in technological developments to ensure that standardisation, if in the interests of the authorities and society, can be started at the most effective time. If government is to

become increasingly involved in standardisation then a more formal attitude to engaging stakeholders should be developed, otherwise there is a chance that some interests will be excluded – risking the legitimacy and adoption of standards. Finally, governments should consider developing greater sensitivity to the range of methods and organisations through which standards can be produced so that competing initiatives can be properly assessed and potentially redirected in more productive directions.

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NOTES

1. The case presented was created with data collected by participant observation of meetings, teleconferences and email discussions of the standards committee in question. It was supplemented with analysis of private and publicly available documents, including archived emails.
2. Central Computer and Telecommunications Agency, now apart of the Office of Government Commerce (OGC).
3. The Open Systems Interconnection Reference Model is a classic 7-layer model used to identify the technological levels (ranging from hardware to advanced software) at which systems and technologies interact with each other. Interactions at any layer assume that they will be translated to the lower layers as necessary. So, for example, a network software interaction assumes that the connecting wires (a lower layer) will function accordingly when the software begins communicating.
4. Formerly Progressive Networks, producer of the RealPlayer and RealAudio technologies.
5. Also known as Electronic Machine Voting.
6. Also known as Online Voting or e-voting.
7. Election.com's public elections services assets were sold to Accenture in June, 2003.
8. Based on author's private archives of IVTA emails.
9. eXtensible Markup Language, a language based on Standard Generalised Markup Language for defining and structuring information.
10. Source: Private email to the author.
11. Voting members were those who had paid a subscription to OASIS and had been active in the committee for more than a probationary period defined by OASIS.
12. Source: Interview conducted 22nd October 2003 with the director of a supplier to the 2003 UK e-voting pilots.

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