



# Network Enterprise: The Shaping of Standards and Institutions

## ESRC E-Society Programme

**E-commerce standardisation has changed significantly during the last decade both in terms of the nature of standards themselves, and the institutions that coordinate standard development. Robin Williams and his colleagues from the University of Edinburgh and University of Manchester, investigated the emergence of business-to-business (B2B) e-commerce based on XML (eXtensible Markup Language) standards and related technologies.**

- The emerging B2B e-commerce based on XML standards and related technologies can be mapped across two layers: local data exchange and standardisation, embedded in local needs and practices, and driven by (large) end user organisations; and, generic hardware standardisation, coordinated globally by system vendors.
- Data exchange standards development is coordinated by local institutions addressing the requirements and interests of specific users.
- The emergence of hardware interoperability standards such as radio frequency identification technologies (RFID) is coordinated at the level of global institutions and is complemented by a range of local institutions which customise the generic standards to meet local needs and practices.
- The range of actors involved in standard development varies according to the type of standard. The emergence of data exchange standards is coordinated locally by users, whereas hardware interoperability standards are coordinated on a global scale by system vendors.
- The study found an active effort to involve end-users in an attempt to facilitate the adoption of the standards within the target community.
- In the case of hardware interoperability standards, global, high-level standardisation is driven by IT manufacturers.

## Background

The e-commerce standardisation landscape has changed dramatically as a result of the internet and related XML based technologies and the growth in the number of institutions that coordinate standards development. We have seen the emergence of a new organisational form, Network Enterprise: networks of organisations linked by information and communication technologies (ICTs) and sharing closely coordinated operations.

Since the mid 1980s the dominant form of e-commerce had been organised around Electronic Data Interchange (EDI) systems and standards. EDI standards represent a uniform format to exchange business information (such as purchase orders and invoices) between computers. However, enabling the automation of data exchanges through EDI standards was found to be complex, rigid and very expensive. The two dominant international EDI standards were developed by two of the largest international standard institutions: UN/CEFACT (EDIFACT) and ANSI (X12). These institutions represented the 'official' bodies, backed by national governments and based on the system of national representation.

During the 1990s two developments in the information technologies (IT) standardisation landscape significantly affected the evolution of the standards for inter-organisational data interchange. First, the development of XML as a subset of the Standard Generalized Markup Language (SGML) for representing documents replaced EDI standards with XML-based message standards. Encoding business information in XML documents with common XML schema eliminated the need for one-to-one information translation. Additionally, as XML documents are text based, it is highly portable. Therefore one of the common applications of XML schemas is to define standards for industry-specific data exchange. XML-based data exchange standards are highly flexible, easy to read, and rely on the open and publicly available internet network.

Second, the 1990s witnessed a significant increase in the demand for inter-operability, the need for anticipatory IT standards and a sharp reduction in IT products and services' life cycle. These developments challenged established standard

Organisations such as ANSI, whose slow and bureaucratic processes were seen as incapable of dealing with these new demands. As a result, new institutions have emerged to coordinate standard development with less formalised, but faster, standardisation processes. These user-driven, informal organisations showed significant growth during the 1990s. Nowadays, e-commerce standardisation has moved out of formal standard organisations such as ANSI and UN/CEFACT into private standard consortia such as RosettaNet and OASIS.

## The Project

The aim of this study was to investigate the emergence of B2B e-commerce based on such XML standards and related technologies. The project investigated two aspects of this process: the emergence of new standards for e-commerce; and, the emergence of institutions that coordinate standard development. The project had three objectives:

1. To assess the balance between the global development of generic business processes based on global XML standards, and the development of XML standards in diverse sectoral communities, based around the needs and practices of specific users.
2. To identify the actors who control the development of standards, the actors that are excluded from this process and the mechanisms through which standard setting constituencies are built.
3. To assess the role that the technical and institutional infrastructure of XML-based e-commerce plays in inter-organisational relationships.

These areas were investigated through three case studies of e-commerce standardisation. The first two cases analysed the development of XML-based standards for data exchange in the Scottish National Health Service (NHS) and in the British long-term insurance industry; the third case looks at the development of hardware interoperability standards, in particular radio frequency identification technologies (RFID) standards in logistics.

Standards are not static artefacts which are created fully-formed and adopted by users in their original

state. Rather once published, many standards undergo a transformation process during use. Changes can occur either as a result of the competitive action of adopters aiming to lock in customers, or due to genuine reasons such as the lack of relevance of some of the features of the standard to the specific contexts of use. At the same time, during implementation and use, standards can be interpreted by users and adapted to the users' specific requirements.

Drawing on social shaping and institutional accounts, the study investigated the factors influencing choices that shape the emergence of standards and the role of the wider institutional environment in framing the emergence of standard institutions.

### **Data Exchange Standardisation in the National Health Service in Scotland**

In 2000 a new approach to the IT strategy of the health service was announced. This envisaged an integrated patient care system across Scotland. The strategy was shaped by both political and economic factors: XML technologies promised to eliminate the technical and cost problems associated with EDI standards, whilst also being in line with the UK wide political mandate to adopt XML for information exchange in all government agencies.

### **Data Interchange Standards in the UK Life and Pension Insurance Industry**

Standardisation in the long term insurance sector was initially based on EDI and driven by Origo, an organisation created in 1989 by major players in the insurance and pensions industry. In 1998 as global support moved towards XML, Origo adopted XML as its message technology strategy. This was paralleled by a change in its overall business strategy, as the portal business was sold and Origo became exclusively a standard setting organisation. The move was driven by two major factors: cost and competitiveness. Common, industry-wide standards enabled industry players to redeploy the same technology across multiple platforms, hence reducing IT system development costs. Standardisation also allowed the same information to be transmitted from a set of systems through any number of channels, thus broadening the range of channels available to Independent Financial Advisors (IFAs) to access product information and thereby supported a competitive market among IFAs.

### **RFID Standardisation in Logistics**

RFID, an automatic identification technology which uses radio frequency, has emerged as a key technology in logistics. Its success has been attributed to its potential to reduce costs, increase transparency and improve the visibility within the entire supply chain. Some of the most influential supporters of RFID are large retailers such as Wal Mart and Metro. Other noteworthy adopters have included governmental agencies such as the US Department of Defence, which has also been seen as important in augmenting the need for fast RFID standardisation.

### **Implications of the research**

#### **Systems Suppliers in Sectoral Communities**

Previous accounts of IT standardisation have demonstrated the pivotal role of hardware suppliers. In the cases studied and role of systems provided, both hardware and software were less central with the greatest involvement in RFID. In both the health and insurance cases the sectoral initiatives were able to 'black box' existing generic technologies, but in RFID, the underlying technology had to be stabilised before RFID could be implemented in distribution.

This distinction between generic and sectoral standards was also observed in the study of the involvement of software suppliers in standards development. Globally there is a small group of very large software vendors, including Microsoft, IBM, BEA, Oracle, Sun and SAP, who are heavily committed to cooperation within standards for a such as OASIS to develop non-sectoral foundational standards for e-business, for example, Web Services. For smaller, albeit often still large multinational enterprises, participation in these fora is strategically less important and their involvement in generic standards development is to maintain awareness of technology developments. The software market, irrespective of user sector, splits between suppliers of bespoke systems and suppliers of packages. Suppliers of bespoke systems develop them to conform with clients' specifications, which may or may not incorporate sectoral e-business standards.

#### **Trust in Network Enterprises**

Within sectoral communities the relationships are long-term with high levels of socially embedded trust. This can be contrasted with transient e-business transactions, such as those conducted on

Ebay, where the technology has to evolve to thwart fraudulent traders. Within network enterprise systems to ensure user confidence the needs are to verify the identities of parties, to ensure that data is exchanged accurately and to be able to audit past transactions. Beyond these three requirements, opportunistic behaviour is policed through socially embedded trust. The trust requirements within sectoral e-commerce can therefore be met by drawing on and implementing generic security technologies.

### Policy Lessons and Future Research

The development of uniform solutions is neither possible, nor desirable. To be effective, data exchange standards have to embed local practices and are enacted in use. Consequently, as in the case of EDI standards, standardisation of XML-based data exchange is coordinated around local communities and institutions.

As with the localisation of the standardisation process within global or local communities, the range of actors involved in standard development varies according to the type of standard. The emergence of data exchange standards is coordinated locally by users, whereas hardware interoperability standards are coordinated on a global scale by system vendors. A variety of emerging structures exist to coordinate data exchange standardisation, with varying degrees of user involvement. Such structures range from highly informal to high formal and from those where there is a high level of end-user involvement but an absence of IT vendors to those where end-users are represented through proxies in the form of information intermediaries and user associations. A combination of institutional rules, political and economic factors determine whether the local institutions are embedded in central organisations within the users field or follow the legitimate rules of organisations within the standardisation domain.

In the case of hardware interoperability standards, global, high-level standardisation is driven by IT manufacturers. A parallel global standardisation process exists in the case of RFID standards. However, as participation here tends to overemphasise a particular industry, the standards tend to be industry specific.

The research found that the emerging B2B e-commerce based on XML standards and related technologies can be mapped across two layers: local data exchange and standardisation, embedded in local needs and practices, and driven by (large) end user organisations; and generic hardware standardisation, coordinated globally by system vendors.

The research conducted by Williams et al has addressed standardisation from the development perspective, ignoring the dynamics of stands in use. The study has identified the need to examine in greater detail the way standards are transformed and adapted during their adoption and how this leads to new versions of standards.

### Further Information

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### The e-Society Programme

Funded by the Economic and Social Research Council and co-ordinated by the Department of Sociology at the University of York, the e-Society is a multidisciplinary programme of research that seeks to investigate how institutions, practices and behaviours are being changed by the technologies that constitute the digital age. This £5 million programme draws on the expertise of leading academics from across the UK. Launched in October 2003, the programme will run until the end of October 2007.

Further details of the projects in the programme can be found at  
<http://www.york.ac.uk/res/e-society/>

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