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Citation for published version:
Bunduchi, R, Graham, I, Smart, A & Williams, R 2008, 'Homogeneity and heterogeneity in information technology private standard settings - the institutional account' Technology Analysis and Strategic Management, vol. 20, no. 4, pp. 389-407. DOI: 10.1080/09537320802141387

Digital Object Identifier (DOI):
10.1080/09537320802141387

Link:
Link to publication record in Edinburgh Research Explorer

Document Version:
Peer reviewed version

Published In:
Technology Analysis and Strategic Management

Publisher Rights Statement:
© Bunduchi, R., Graham, I., Smart, A., & Williams, R. (2008). Homogeneity and heterogeneity in information technology private standard settings - the institutional account. Technology Analysis and Strategic Management, 20(4), 389-407doi: 10.1080/09537320802141387

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Homogeneity and heterogeneity in IT private standard settings – the institutional account[1]

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Abstract:

The IT standardisation landscape is currently characterised by three developments: the increasing importance of private standard setting consortia, greater convergence between the structural features of formal and private standard organisations, and greater diversity in standard organisations. Whereas institutional theory has been applied to explain the convergence of standard setting bodies), past research has only examined standard settings heterogeneity that was determined by economic goals (David and

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[1] This is a preprint of a paper accepted for publication in Technology Analysis and Strategic Management, vol. 20, 2008.

Shurmer, 1996). This paper applies institutional theory to address both diversity and similarity in IT private standard consortia. We argue that there are homogenising forces in standard setting resulting from mimetic, coercive and normative pressures that lead to a certain conformity of emergent organisations with the institutional features within the users field (where standard adoption takes place) and the standardisation domain (where standard creation takes place). There are also factors promoting heterogeneity, in particular the multiplicity of institutional fields within which organisations operate, which leads to a complex and often conflicting set of institutional norms that have to be accommodated. The paper uses four private standard organisations to illustrate interplay between trends and pressures towards heterogeneity and homogeneity. The study contributes to institutional research through extending existing research on institutional sources of organisational diversity.

Keywords: IT standards, standardisation, standard consortia, institutional theory

Introduction

Institutional isomorphism theory (Di Maggio & Powell, 1983) argues that organisations will conform to the 'appropriate' and 'efficient' characteristics of other organisations in their institutional field. The theory has been widely applied to explain structural similarities between organizations, but by and large only institutionally homogenising pressures have been considered. Some writers have, however, argued that institutional theory can be extended to explain the diversity of organizations operating within the same sector (Greenwood and Hinings, 1996; Hoffmann, 2001), as organisations are exposed to counteractive institutional forces from diverse fields. This paper examines the processes of convergence and divergence occurring within the development of technology standards. It suggests that the institutional lens can be used to explain both the homogeneity *and* the heterogeneity observed within a single institutional setting.

Literature Review

Institutional theory: homogeneity and heterogeneity in organizational forms

Institutional isomorphism theory (Di Maggio and Powell, 1983) argues that regularized organizational behaviour is the product of ideas, values and beliefs that originate in the institutional environment. Organisations conform to what is regarded as appropriate in their environment, rather than to economic pressures for efficiency and organizational performance. Conformity to institutional norms – the societal expectations of appropriate organizational action - informs the structure and behaviour of organisations (Meyer and Rowan, 1977). The process of accommodation to a set of institutionalized beliefs leads organizations operating within the same field to adopt similar organizational forms. This understanding is central to institutional isomorphism theory: conformity to institutional rules creates structural similarities, termed isomorphism, between organizations (Meyer and Rowan, 1977; Zucker, 1987). DiMaggio and Powell (1983) define isomorphism as *"a constraining process that forces one unit in a population to resemble other units that face the same set of environmental conditions"* (p 149).

An organizational field is defined as *"those organisations that, in the aggregate, constitute a recognized area of institutional life"* (DiMaggio and Powell, 1983, p 148), and includes key suppliers, customers, regulatory bodies, competitors, special interests group, the general public, and professional and trade associations (Scott, 1991). An organizational field is therefore wider than industrial sector, leaving unresolved the question of where the boundaries of the filed lie. "Isomorphism" develops from the structuration of an organizational field into an interconnected collectivity that draws organisations towards homogeneity. Institutional theorists argue that as an organizational field

becomes more interconnected (as the number of transactions or formal relationships between organisations increases) organisations become more embedded in their institutional environment and organizational diversity reduces (Baum and Oliver, 1992; DiMaggio and Powell, 1983).

DiMaggio and Powell (1983) differentiate three mechanisms, arising from organizational interconnectedness, that lead to isomorphism:

(1) *coercive isomorphism*. Coercive isomorphism results from formal and informal pressures exerted on organisations by other organisations upon which they are dependent, and by cultural expectations in the society within which organisations function. For example, governments, keen to foster market competition, encourage standards bodies to be open to new members (Werle, 2001).

(2) *mimetic isomorphism.* Mimetic isomorphism induces an organisation to imitate other organizational structures and practices that are seen as successful in the field. High uncertainty, poor understanding of organizational technology and ambiguity in definition of goals encourage imitation. New standards organisations, for example, tend to emulate the organisational and institutional structures of incumbent SDOs (Werle, 2001).

(3) *normative isomorphism*. Normative isomorphism is primarily exerted through professionalisation. There are two aspects of professionalisation that lead to isomorphism: (a) the legitimation of formal education and of knowledge produced by university specialists; and (b) the growth of professional networks that span organisations. The significance of professionalisation in standard settings was analysed by Lawrence (1999) in the context of the Canadian forensic accounting sector.

Institutional isomorphism theory claims that organisations within the same population, facing the same set of environmental constraints, will tend to become isomorphic to one another and aligned to their environment, through coercive, mimetic and normative pressures,. Institutional theory emphasises conformity to institutional rules and the embeddedness of organisations within organizational fields, thus explaining homogeneity between organisations. The theory is an explication of the similarity and stability of organizational arrangements in a given field (Greenwood and Hinings, 1996). DiMaggio and Powell (1983) argue that, in adopting the institutional perspective, *we seek to explain homogeneity, not variation"* (p 148). However, this focus on isomorphism has been criticised for placing too much emphasis on the homogeneity of organisations, and for not being able to account for the empirically observed diversity within organizational fields (Dacin et al, 2002).

In response to this criticism, a number of researchers have applied institutional theory to study the discontinuity of institutionalised organizational activity (Oliver, 1992), organizational change (Greenwood and Hinings, 1996) and firm heterogeneity within a particular field (Hoffman, 2001). Current institutional research suggests that organizational diversity arises from two factors:

(1) Organizational factors

Organizational responses to institutional pressures depend on the interaction between various organizational actors and the organizational fields within which they operate. Organisations are composed of different groups, pursuing different goals and promoting different interests, hence varying in their internal organizational dynamics. Different organizational dynamics lead to
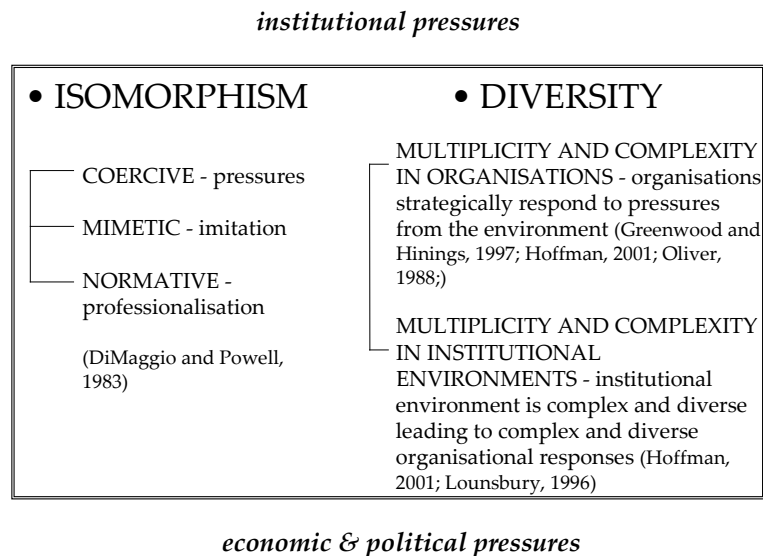
different organizational responses to the same institutional context (Greenwood and Hinings, 1996). Consequently, organizational heterogeneity can be explained based on the diversity in organizational values, interests, power and capacity that characterise organizational action (Greenwood and Hinings, 1996) and in organizational cultures (Hoffman, 2001). The underlying logic is that organisations choose how to respond to the same institutional pressures. This view has its roots in Child's strategic choice perspective (1972). Child argues that organisations have the capability to exercise discretion over the nature of changes to their own structures, and the timing of any changes, in response to environmental contingencies. Organisations react strategically to institutional pressures (Oliver, 1991), with different responses to similar institutional pressures. Hence, diversity in organizational structures is observed.

(2) Institutional factors

A second source of organizational heterogeneity is the institutional context itself. Two explanations are advanced in the literature. First, a firm can operate within multiple organizational fields (Lounsbury, 1996) and so be influenced by different, possibly conflicting, institutional pressures. Second, the institutionalised norms in a field may be highly diverse and complex, which can explain the diversity in organizational responses (Hoffman, 2001). However, institutional literature pays less attention to the institutional environment(s) as a source of diversity within organizational forms than to organizational factors.

In conclusion, institutional theory can be applied to explain heterogeneity as well as homogeneity in organization forms arising from organizational responses to institutional pressures. Figure 1 summarises the institutional explanations of heterogeneity and homogeneity between organizational forms.

Figure 1. Institutional sources for heterogeneity and homogeneity in organisational forms

institutional pressures

• ISOMORPHISM	• DIVERSITY
COERCIVE - pressures MIMETIC - imitation NORMATIVE - professionalisation (DiMaggio and Powell, 1983)	MULTIPLICITY AND COMPLEXITY IN ORGANISATIONS - organisations strategically respond to pressures from the environment (Greenwood and Hinings, 1997; Hoffman, 2001; Oliver, 1988;) MULTIPLICITY AND COMPLEXITY IN INSTITUTIONAL ENVIRONMENTS - institutional environment is complex and diverse leading to complex and diverse organisational responses (Hoffman, 2001; Lounsbury, 1996)

economic & political pressures

Institutional analysis has been applied to IT development and implementation (Avergerou, 2000; Butler, 2003; Chatterjee *et al*, 2002; Orlikowski and Barley, 2001). The existence of IT standards, by their nature, represents a force towards greater isomorphism within their community of users, but the institutional processes lying behind the emergence of standards has been under-researched.

The standardisation field

The requirement of users to transfer data between many different forms of information technology (IT) systems has led to the development of a wide range of standards concerned both with hardware interoperability and with the format of data messages. During the 1980s the increasing pace of IT innovation and changes in the character of IT products increased the requirement for standards and altered the way in which standards are produced. Standardisation requires a process to balance the conflicting requirements of interested actors: for functionality embedded in the standard and also for its speed of development. It is recognized that standardisation is a complex social activity involving a diverse cast of actors that extends beyond identifying the technically optimal solution (King et al, 1994; Hanseth et al, 2006).

Markus et al (2003) differentiate between two types of IT standards: *horizontal* IT standards, which can be applied across different industries and which reflect the interests of IT producers, and *vertical* information system standards which are industry-specific. Whereas horizontal standards initiatives tend to be driven by IT vendors, vertical standard consortia are generally established by end-users. A similar distinction can be identified between cross-industry consortia, such as the Worldwide Web Consortium, which develops generic IT standards, and industry specific consortia such as RosettaNet, which develops business process standards that address the needs of the electronics industry.

Traditionally, standardisation researchers differentiate between three forms of standard setting: (i) *de facto* standardisation, where a single firm's specification becomes regarded as a standard as the community of adopters grows; (ii) formal standardisation, taking place within recognised standards

development organisations (SDOs), most notably the International Organization for Standardization (ISO); and (iii) consortium standardisation, within less formal private standards consortia (PSCs) set up by groups of organizations to address their specific standardisation needs (David and Shurmer, 1996). Consortia include organizations such as OASIS, which develops web services standards. PSCs are a hybrid between *de facto* standardisation and formal standardisation, combining the strategic commercial logic of *de facto* standardisation with the need to negotiate compromises between interested parties, as seen within the formal standardisation processes.

During the last few decades, three trends have characterised the IT standardisation landscape:

(1) Increasing importance of PSCs

The formal standardisation processes of ISO, based around national representation and consensus decision making, have increasingly become seen as slow and bureaucratic, especially in areas where technology has been developing rapidly, most obviously in IT. In parallel with this disenchantment there has been a growing unwillingness to allow powerful players to define standards unilaterally, as has been seen with Microsoft. In the face of these pressures it is unsurprising that there has been a rapid growth in the number of PSCs, in which actors can agree their own decision making rules and avoid the dangers of handing control of standards to single entities (Hawkins, 1999).

(2) *Greater choice in the organizational forms of PSCs*

Whereas SDOs are largely homogeneous in their formal structures, procedures and membership requirements, the PSC domain is highly diverse,

ranging from user groups to trade associations (David and Shurmer, 1996). The only common feature across the range of PSCs is their claim to reconcile the needs of diverse members. This is in contrast to the SDOs' adherence to technocratic idealist principles, and there claim to be developing standards that meet the needs of everyone (David and Shurmer, 1996, Hawkins, 1999). The actors developing standards within SDOs are constrained by the rules and structures of the host organisation, actors in PSCs have greater freedom to choose structures, rules and procedures which meet their particular needs.

(3) *Increasing convergence between the structural features of SDOs and PSCs*

The third trend noted in the standardisation landscape is the increasing convergence between structural features of SDOs and PSCs. Two explanations are proposed in the literature to explain this convergence. First, SDOs are altering their structures and procedures to reduce bureaucracy and increase the speed of their standardisation processes in an effort to respond to the market pressures for the rapid production of standards. Such reforms bring SDOs' processes closer to the faster and more informal processes of PSCs (David and Shurmer, 1996; Schoechle, 2003). Second, in an effort to increase their legitimacy within their user community, PSCs emulate features of SDOs by adopting some of the principles that have characterised the formal standardisation domain (Bunduchi et al, 2005). Whereas the reform of SDOs is explained in terms of economic goals (David and Shurmer, 1996), the transformation of PSCs is seen as resulting from institutional pressures (Werle, 2001). By increasing the structural similarities between PSCs and SDOs, these transformations also increase homogeneity within the PSC domain.

This paper applies the institutional explanations to IT standard setting to identify the potential causes of empirically observed trends towards both homogeneity and heterogeneity in IT standard setting consortia using four case studies that are rooted in the standardisation field.

Methodology

The study used an exploratory case study approach to examine the evidence for homogeneity and heterogeneity in IT standards setting consortia. The cases include the standardisation of clinical data exchange in the National Health Service (NHS) in Scotland (Case 1) and in England (Case 4), the standardisation of business processes in the British long-term insurance industry (Case 2) and the standardisation of Grid technologies, a new form of distributed computing based on web services (Case 3). All cases represent private standard consortia and belong to the IT standardisation field. Whereas Cases 1, 2 and 4 illustrate industry specific standardisation efforts (vertical PSC), Case 3 demonstrates a global, cross-industry initiative (horizontal PSC). Full details of the four cases are given in the next section. The choice of case study research design was informed by the aim of this research, which is to obtain a rich and in-depth picture of the standardisation field in order to explore the causes for the empirically observed trends towards both homogeneity and heterogeneity in PSCs. Qualitative case studies are appropriate in this situations as they enable the researcher to explore a "bounded system" (the private standard consortium) and to obtain a detailed and in-depth understanding on the case and the phenomenon under study (Creswell, 1994, Stake, 1995).

Data collection and analysis followed an interpretative case study approach (Walsham 1993). The interpretivist approach is based on an ontology

that reality is subjective, socially constructed by individuals according to their beliefs and value systems. Consequently, the research was informed by the need to understand the institutionalisation of the standardisation field through eliciting the meanings that the actors operating in the field assign to them. An exploration of the cultural and historical context in which these actors operate was hence necessary to facilitate this elicitation process. In accordance with the interpretative tradition, interviews were used as the major source of data collection. In total, 30 informants were interviewed across the four cases, using semi-structured interviews. Details of the interviewees for each case are shown in Table 1. Some interviewees and documentation provided evidence for both the XML-Steering Group (NHS Scotland) and HL7 UK (NHS England) case, which accounts for total number of interviewees in Table 1 apparently exceeding 30. The interviewees represented the entire range of organisations involved in the IT standardisation field: standard setting bodies, end-user representatives, IT vendors, and public organisations. The interviews were semi-structured and an interview guide was used (Patton 1980). Interviews were transcribed and then returned for the interviewees to check for accuracy (Payne 2000). The interview data was augmented by reviewing relevant documentation for each case.

Table 1. Interviewee details for each case

Case	Area	No of interviewees
Grid	Academia	2
	Industry	3
Origo	Origo	6
	IFA (small users / participants)	1
	Software vendors (users / participants)	2

	Insurance companies (sponsoring organisations / large users / participants)	2
NHS Scotland	Policy makers	5
	User / participant	6
	User / local hospital	3
HL7	User (consultant / NHS) / participant	3

The validated interview transcripts and documents associated with each case were analysed in accordance with techniques outlined by Miles and Huberman (1994), making comparisons, noting relationships between variables and identifying patterns and themes. The descriptions of the cases below are based on the narratives developed during data analysis (Stake, 1995).

Illustrative cases

Four case studies are presented here to illustrate, by reference to practice, how homogeneity and heterogeneity arise within the PSC domain. The cases are drawn from a two-year research project looking at the emergence of XML-based e-Business standards and related Internet technologies. Their characteristics are summarised in Table 2 and discussed in detail in the rest of this section.

Table 2. Summary of key features of cases

	NHS Scotland	**Origo**	**Grid**	**HL7 UK**
Process	Open, informal, transparent	Highly formalised, but relatively open & transparent to members	Limited formality, open and transparent forums (GGF / OASIS etc)	Highly formalised, closed and opaque
Control	NHS Scotland	Independent, but relies on its sponsor member's fees (large insurance companies)	Independent/voluntary participation - increasingly driven by vendors	Affiliate of an international organisation, but relies on (local) sponsor member's fees (NHS England & system vendors)
Members	• NHS Scotland IT programmes (major users) • Clinicians (end users) • Limited vendor involvement	• Large insurance companies • Portals & vendors • Limited IFA (end users) involvement	• Computer scientists (academic) • Increasing participation of system vendors (commercial)	• Vendors • NHS England IT programmes representatives
Focus	Speed of development ("good enough" standard)	Fit with the interests of its members (commercial standard)	Originally – support the emergence of new technology Increasingly – fit the interests of the commercial vendor community	Technical performance ("gold" standard)
Source of legitimacy	End user involvement	Heavy formalisation, copying the procedures of established "legitimate" SDOs More recently – through wider involvement of end users	Established IT standard consortia	Support and involvement from the institutional representative of users (NHS) Vendor support

Case 1. Health informatics in NHS Scotland XML Steering Group: embeddedness in the users' organisational field

The NHS in Scotland operates, to a large extent, independently of the NHS in England and is funded and overseen by the devolved Scottish Executive. The agenda it has developed for information technology adoption is largely independent of that established in England, although both organizations have been required by the UK government to adopt XML standards for IT applications. In 2000, NHS Scotland announced a new approach to IT strategy which envisaged fast development of an integrated electronic patient care system across Scotland. Central to this integrated system was the elaboration of standards for clinical data exchange to specify the structure and content of the clinical data messages within the system, including referral and discharge letters and laboratory results.

Within NHS Scotland the same team has been involved in developing both the data standards and the core software components of the electronic patient record system. The process is controlled by the XML Steering Group, which is part of the NHS Information and Statistics Division. The process is hence embedded in the NHS Scotland organisational structure.

The Steering Group was set up in 2000 and was designed as a forum to monitor the changes in the clinical messaging standards. Participation is open to everyone interested, no membership fees exist, and there is no formal procedure in place to regulate its proceedings. On the one hand, the open and transparent nature of the forum resembles the formal, traditional standardisation process characterised by strict abidance by technocratic principles, requiring wide

participation, consensus and transparency (David and Shurmer, 1996). This openness and transparency is also in contrast to 'typical' groups within the NHS, which are closed and where membership is restricted (for example, the Royal Society of Surgeons). On the other hand, the informal nature of the forum is significantly different from the formal approach that characterises the standardisation field. Traditional standard committees are generally governed by procedures and rules with varying degrees of formality (David and Shurmer, 1996). The open, informal and transparent structure of the approach undertaken by the NHS in Scotland was deliberately chosen to facilitate the involvement of clinicians in the standardisation process. This clinician involvement was perceived as essential for the widespread adoption of the standardised technology throughout local NHS organisations. Clinician involvement in standard development was deemed desirable because it would (i) help towards the elaboration of schemas that fit specific clinical requirements; and, more importantly, (ii) enable clinicians to develop a feeling of ownership of something that affects their work, and consequently reduce their resistance to the adoption of the standardised technologies. The emphasis placed on clinical involvement was also illustrated by forum's efforts to train and educate the clinical community about the crucial significance of data standards through seminars and workshops.

The Steering Group includes representatives of the major NHS IT programmes, software vendors and clinicians. Work on the development of standards has been driven by the major NHS IT programmes, Scottish Care Information (SCI) and Electronic Clinical Communication Implementation (ECCI) - the main users of the standards embedded in the products. Their

representatives were, by and large, clinical IT professionals working within NHS Scotland. The clinicians involved in steering group were those who share a particular interest in IT in general, and hence are related to the network of Scottish clinical IT professionals. In contrast, the involvement of system vendors has been limited. Most of the IT health care vendors are involved in the much larger (in comparison with Scotland), and hence potentially more profitable, English and American markets, both of which have adopted HL7, an international standard for clinical data messaging. When two different standards are being developed suppliers are more likely to commit there resources to the standard the offers higher returns; in this case the economies of scale for suppliers were likely to result from the significantly larger market in England. .

The focus of the standardisation process in NHS Scotland has been the development of "good enough" standards that meet the requirements of the systems as they develop, with an emphasis on speed rather than technical quality. Standards have been developed in parallel with systems, and the process is subsumed within systems development. The process is coordinated by NHS Scotland and is incorporated within its institutional structures – the Steering Group is part of its Information and Statistics Division. The alternative would have been to become involved in an existing PSC such as HL7, which would have provided NHS Scotland with the support of IT vendors. Nevertheless, the formal procedures of such a PSC would have inhibited the ability of NHS Scotland to control the process and ensure that the emergent standards met their requirements, significantly slowing the development process and consequently the development and implementation of the electronic patient record system. This can be seen by comparing the position in Scotland with that in England:

systems implementation in NHS Scotland is significantly ahead of that in NHS England, which committed to the HL7 standard.

This case illustrates a strong element of mimetic and normative isomorphism between the PSC and the adoption context. As with all PSCs, the XML Steering Group operates at the intersection of two organizational fields, the standardisation domain and the NHS Scotland context. Institutional pressures arising from these two organizational fields shape the norms and procedures of the Steering Group: for example, the group follows typical standardisation norms such as open and transparent procedures, but at the same time the coordination of standard development is carried out within the organizational structure of NHS Scotland. Embeddedness within the users' field also explains a highly informal approach to standard development, focused on speed rather than on technical quality; the desire is to achieve fast system development and to facilitate wide participation and adoption by users. There is no great need for legitimacy from users beyond the boundaries of NHS Scotland, meaning that strict abidance by the norms of standardisation bodies is not an overwhelming concern. Farrell and Saloner (1988) have suggested that participation in a more formal standard organisation, such as HL7, could have significantly prolonged the standards development process. Constraining the standard setting within a local organizational structure also allowed the Scottish Executive to retain tight control over the process, while at the same time enabling strong clinical involvement to provide legitimacy for the standardisation process and hence to speed up adoption. The limited involvement of the system suppliers meant that the process was dominated by NHS Scotland IT clinical professionals, with limited interference from outside the national professional boundaries. The case

illustrates the mechanism of institutional isomorphism (DiMaggio and Powell, 1983), with the XML Steering Group adopting similar institutional practices to the user environment.

Case 2. The long-term insurance industry in Britain – Origo: embeddedness in the standardisation field

The standardisation of data interchange in the British long-term insurance industry is coordinated by Origo, a UK-based standard setting consortia. Origo was created in 1989 by the major life and pension insurance companies, who wished to set up an industry portal to provide an automated service facilitating data exchange between insurers and independent financial advisers (IFAs – who act as intermediaries between the large insurers and their end customers). In 1998, the insurers sold the division operating the portal. Origo was focussed exclusively on the development of common business processes and technical industry standards to enable inter-organizational data interchange within the industry.

The major driver for this change, which resulted in Origo becoming solely concerned with standard setting, was the introductions of new government regulations. These regulations forced insurers to reduce their cost base and to support a competitive market for the If's who sustain the distribution of insurers' products. The development of common, industry-wide, business processes and technical standards served both purposes. The use of common standards enable insurers to redeploy the same technology across multiple platforms, hence reducing IT system development cost. The common standards also allow the same information to be transmitted from a variety of systems through any number of channels, thus broadening the range of channels available to If's to

access products information. These measures further support competition within the market.

The decisive role that British government regulations have had on shaping the emergence of Origo is explained by the nature of the long term insurance markets. The markets are heavily regulated in most countries, with significant differences between national markets resulting from differences in local regulation. Consequently, the transfer of standards from one market to another is rarely, if ever, feasible resulting in the need to develop local standards. This is, in contrast to other types of markets where data exchange standards travel well across national boundaries (for example, health or retailing). Specific local regulation hence explains the need for locally coordinated standardisation processes observed in the case of Origo.

Origo membership reflects the nature of the British insurance industry, which is dominated by a few large insurance companies (in 2004 the top 10 insurance companies accounted for 68% of the market (ABI, 2004) while 80% of the IFA sector is made up of small- and medium-sized businesses (Aitchison and Stone, 2002)). Insurance companies represent approximately 6% of the total registered members of Origo; however they dominate standards development activity. Approximately half of the members of a typical Origo working group in January 2005 represented insurers (56%). The remaining members represented IFAs (14%), service providers (14%) and software vendors (10%). The work is hence dominated by IT professionals representing British long term insurers who work with Origo staff, who are predominantly IT professionals with experience in the British insurance industry.

The Origo standards development process is highly formalised, following the pattern of established public Standards Development Organizations, with clearly defined rules and procedures. Development work is organised within different working groups, decision-making is consensus-based, participation is voluntary and open, access to standards is free (though the insurance companies who pay a subscription) and the process is transparent, with information freely accessible to registered members on the Origo website. There is a very clear rationale for this highly formalised approach – in order for the standard to be of real value it has to be accepted and adopted by the whole IFA community. This is important given that one of the key reasons for the initial establishment of Origo was a response to government regulations which required the ongoing viability of the IFA base that serves the insurers. The high degree of formalisation in the process is designed to give legitimacy to the standards by creating the impression of an impartial body, with strict abidance by formal rules resulting in the interests of all parties being taken into account during the standard development process. This is very much in keeping with the aims of formal standards development organizations, which achieve legitimacy as a consequence of a strong degree of isomorphism with the standardization field. The long term insurance sector is highly institutionalised and isolated, through heavy regulation, from a potentially global insurance market. In the absence of a central coordinating organisation to represent all users requirements, legitimacy can be acquired only through wide involvement of all industry players, rather than through "institutionalised" user representatives – (this is in contrast to the case of NHS England's involvement in HL7 UK, which is described in Case 4). Unless Origo can be seen as the legitimate standardisation body in the field,

representing the interests and claims of all participants, and supporting the development of the "best technical" standards, the adoption of Origo standards is threatened; industry players could see the standardisation process as supporting the interests of a limited community of industry players. Legitimacy is therefore attained through abiding by the norms that characterise formal standardisation. The case illustrates the mechanisms of mimetic and coercive isomorphism in standard setting. Origo imitates the model of successful SDO structures to ensure its legitimacy as a standardisation body in an effort to facilitate the adoption of the standards by end-users (as suggested by Werle's (2001) study). It has also responded to the need for a neutral standardisation process to support a competitive market. This embeddedness within the standardisation field results from the combined mimetic and coercive institutional pressures for legitimacy within the IFA community.

Case 3. Grid technologies – GGF and OASIS: multiplicity of organizational environments within the users' organisational contexts

Grid computing emerged during the mid 1990s as academic computer scientists sought to exploit network computing architectures, with computation distributed across a network of computers that might be geographically dispersed. The success of Grid applications in the natural sciences opened the path for commercial uses, ranging from financial services to the pharmaceutical industry. Since the late 1990s all of the largest IT systems vendors have become involved in Grid development; however they vary significantly in their underlying approach to what Grid technologies. For example, IBM and Sun emphasise the outsourcing of computing power, Hewlett Packard uses the Grid

to facilitate data storage, while for Oracle the Grid represents an extension of clustering capabilities in its databases.

Grid computing requires standards to ensure that the applications which run on it can be distributed. Grid technologies are based on Grid specific standards and on Internet and web service standards. The latter are developed within PSCs such as the World Wide Web Consortium (WC3), the Internet Engineering Task Force (IETF) and OASIS. Grid specific standards were initially developed within the Globus Alliance, a consortium driven predominantly by the computer science research community. The alliance developed the Globus Toolkit, a de facto standard for Grid technologies. In 1998 the development of Grid standards moved under the auspices of the Global Grid Forum (GGF), a research community standards consortium based in the United States. The GGF was created in an effort to support a legitimate process for the development of agreements and specifications regarding the Grid, and to serve as an open and transparent forum for information exchange and collaboration between Grid researchers. The computer academics that initiated the GGF deliberately modelled it on the Internet Engineering Task Force, with similar working groups, documentation processes and workshop structures, as well as open participation and transparent distribution of information. The IETF was seen as a legitimate model of standardisation in the field, as many academic computer scientists were members of, or were interacting with, the IEFT forum already. Over the years, the commercial involvement in the GGF has increased significantly, with over 25% of the GGF participants currently representing industrial members.

In March 2004, IBM and Globus Alliance submitted a new Grid specification to OASIS. The new specification reorganizes the internal structure

of the existing GGF's standard without changing its external behaviour in order to ensure a stronger alignment between the Grid and web services standards. This alignment benefits the IT industry as a whole, as it enables IT vendors to reuse web service programming tools and language to develop Grid applications. The change in the standard was primarily driven by pressure from IT vendors, who indicated that they would not adopt the standard as it was then defined (Baker, 2004). OASIS is dominated by IT vendors and focuses on web service standards. The Web Services Resource Framework Technical Committee within OASIS includes most of the larger IT vendors who are involved in web service developments for the Grid, including IBM, Hewlett Packard, and Oracle. Consequently, parts of the Grid specific standards are moving out of the academic-driven GGF consortium into the more commercially oriented OASIS forum, while other parts, such as security and scheduling standards, remain within GGF's remit.

In addition to GGF and OASIS, a plethora of private standard consortia have developed during the last years to address specific areas of Grid standards. These consortia include the Data Centre Markup Language, begun in October 2003 by a number of small IT vendors, the Enterprise Grid Alliance founded by Oracle in April 2004, and the Globus Consortium created in January 2005 by IBM. These PSCs are characterised by overlapping membership and areas of activity, often representing divergent interests within the commercial Grid standards producer arena. The PSCs reflect the different Grid strategies of the IT vendors and their attempts to build a community of supporters around their own particular approach. Elaboration of standards is thus taking place in a number of

different fora, some of which are closely aligned with commercial adoption contexts and others of which are closely aligned with academia.

The Grid case illustrates heterogeneity in standard setting due to the multiplicity of the organizational environments that characterise the PSC standards adoption context. Grid standards, in contrast to the health and insurance standards exemplified in the other three cases, are what Markus et al (2003) call 'horizontal standards'. Horizontal standards address a global, multi-industry environment. They are hardware interoperability standards, applicable to many industries, rather than to industry-specific business processes or data interchange. Each of the users operates in different, highly institutionalised, organizational fields: computer science academics versus IT vendors, academic users versus commercial users. These fields are characterised by different institutional norms; for example, for-profit sectors differ significantly from not-for-profit sectors (DiMaggio and Anheier 1990). Consequently, the adoption of standardised Grid computing occurs in settings characterised by different, often divergent, institutional frames. However, as Jakobs (2000) noted, in the case of horizontal IT interoperability standards, the end-users are generally represented by IT vendors, in contrast to vertical, industry specific standards where end users are themselves driving the development process (Markus et al, 2003). Therefore, Grid standardisation reflects the institutional dichotomy between the two major Grid producers: the academic (computer scientists) and commercial (IT vendors) producers, rather than the diversity in end-user settings. The GGF is an academic-driven PSC, reflecting the needs and interests of the academic community, particularly the computer scientists who initiated Grid computing. Whilst Grid technologies were still experimental and largely deployed only

within the academia, GGF was seen as the legitimate standardization body within its academic target population. Consequently, IT vendors were happy to operate within an academic-driven PSC. However, since commercial Grid applications have gained momentum, IT vendors have defected from the GGF process and switched to the IT vendor-driven OASIS consortium. Moving Grid standards within a vendor-driven consortium allows IT vendors to control the Grid standardisation process to ensure a better alignment between Grid standards developed in the academic milieu and already existing, commercially driven, web services. It also gives the process the required legitimacy as OASIS is seen as the central PSC for the development of XML and web services standards in the commercial community. Consequently, for the Grid, the co-existence of different types of PSC can be explained based on the multiplicity of institutional fields that the standardisation process has to accommodate. The institutional pressure operates in conjunction with strategic forces that have led to heterogeneity in the Grid standard setting bodies. It is unclear whether this heterogeneity will remain as the technology and its applications develop or whether isomorphism between the different standardization bodies will be forced by the need for a single family of standards in order to ensure the complete compatibility of all Grid applications.

Case 4. Health informatics in NHS England - HL7 UK: Tensions between the standardisation field and users' organisational field

In 1998, the NHS Information Authority (NHSIA) in England launched the National Programme for Information Technology (NPfIT), a radical approach to IT service provision based on a new, centrally developed, system. As in the case of the new Scottish health IT strategy, a crucial requirement for the development

of this system was a standard for clinical data messaging that would allow a consistent approach to the exchange of clinical data throughout the English NHS. In 2000 the NHSIA announced the adoption of HL7 version 3 as the national standard for clinical and administrative data in health care. The standard setting body responsible for the development of HL7 version 3 in Britain is HL7 UK. HL7 UK was established in January 2000 as an international affiliate of HL7, a US-based private standard consortium. The HL7 US consortium had been created in 1987 as an open consortium of health-care providers and system vendors.

The NHSIA's choice of HL7 version 3 was primarily driven by the strong support HL7 received from system vendors operating in the English market, who preferred it to operate within the PSC field. Whereas vendors can directly influence developments within a private standard consortium such as HL7, their influence within formal, official SDOs such as ISO is constrained by the system of national representation (Graham et al, 1995). Choosing a private standard consortium approach also enabled the NHS to retain a strong influence over the process of standards development. Consequently, the emphasis in the standardisation process has been on the need to ensure that the interests of the actors are represented during the process, rather than on the need to ensure legitimacy through participation in formal a SDO.

Although the choice of a private consortium approach would seem to support supplier involvement in development, as is seen in the wider HL7, within HL7 UK the NHS has become the major driver of standards development work, with a significant level of NHS participation within HL7 UK working groups. The majority of the NHS representatives come from the central

authorities responsible for the IT strategy and standards, such as Connecting for Health, the body overseeing NPfIT, and the NHS Information Standards Board, rather than representing local clinical users. With very low involvement by clinicians, the HL7 UK procedures reflect the vision of the NHS IT representatives, rather than of clinical experts. Whilst the strong technical focus of the activities within HL7 UK could justify the lack of clinical involvement, the lack of participation by clinicians may create difficulties not only in the process for identification of user requirements, but also in creating buy-in to ensure the future adoption of the HL7 standards.

The actual development work, as opposed to mere representation, is undertaken almost entirely by technical consultants (both independent and from the NHS) rather than by technology vendors. The low vendor involvement is the result of the conflict between the nature of the vendor-driven process in the wider, international, HL7 and the context of adoption in England. One result of the difference in the characteristics of the NHS and of HL7 institutions generally is a lack of transparency during the standards development process within HL7 UK. In order to protect the confidentiality that surrounds NPfIT, only a very limited number of documents about HL7 UK standards development process have been made publicly available; generally, access to the standards specification has been severely restricted. Such an opaque approach to standards creation is in contrast not only to the official SDOs procedures (David and Shurmer, 1996), but also to other private consortia (Choi et al, 2004).

The NHS England HL7 standardization activity is therefore atypical of the PSC standardization field. HL7 UK exemplifies heterogeneity resulting from the emergence of a hybrid standardization organisation that conforms neither to the

PSC field nor to the adoption environment. The emergence of the HL7 UK consortium has been characterised by a significant conflict between a highly institutionalised standards development field (HL7) and a highly institutionalised adoption context (NHS England). Tensions between the relational networks that characterised the two domains, demonstrated by different institutional norms (openness and transparency in HL7 versus closed and opaque procedures in NHS England) have undermined the structure of HL7 UK. For example, whereas participation in HL7 UK is voluntary, and the structure follows a typical PSC in conforming to standardisation norms, adoption of the standards in NHS England is compulsory, and proceedings are confidential, in accordance with the typical rules characterising NHS England. There is thus a conflict between mimetic isomorphism, as HL7 UK duplicates the structures of its parent organisation, and coercive isomorphism which is forcing HL7 to adopt the norms characterising NHS England, the driver of standard development in HL7 UK. Although the lack of user involvement may be conceived as reducing the legitimacy of the standards developed by HL7 UK, the existence of the NHS Information Authority within the highly institutionalised adoption context provides the required legitimacy to any initiative that gains its involvement, despite the absence of any end-users (Benson, 1975). Consequently, in contrast with the Origo case, the legitimacy of the standardisation process arises from the involvement of the central adopting organisation, and not from the embeddedness of the standardisation process in the standardisation field. However, whilst end-user involvement is not required to support the legitimacy of the standardisation effort, vendor acceptance is crucial. The development of the IT health strategy in England has been shaped by significant economic and

political pressures for increased efficiency and performance, and for cost reductions. The sheer scale of the NHS England market means that a nationwide integrated patient care system cannot be achieved without strong vendor support (unlike in NHS Scotland, where the main systems were developed in-house). With the withdrawal of one vendor and possible accounting irregularities being investigated at another there is the potential for major disruption to the implementation of the system. The hybrid nature of HL7 UK is thus explained not only by the tensions between two divergent and highly institutionalised fields (Bunduchi et al, 2005), but also by the concentrated action of economic and political forces which, together with institutional pressures, explain why NHS England has chosen an internationally accepted PSC to coordinate standard development, but has subsequently tried to force the PSC to operate in way that it does not conform to the norms of the PSC standardization field.

Discussion: Sources of heterogeneity and homogeneity in PSCs

The institutional pressures leading to homogeneity or heterogeneity in each case are summarised in Table 3.

Table 3. Key institutional mechanisms present in the cases

PRESSURES	NHS Scotland	Origo	Grid	HL7 UK
MIMETIC	*informal process to support user involvement* **open and transparent process to support user involvement**	**open, transparent and formal process to support user involvement**	**copying IEFT norms to ensure legitimate process within the computer academic research community** *multiplicity of institutional fields inhabited by users / developers => different commercial oriented consortia*	*copy the formal and committee based structure and procedures of standard developing organisations to gain vendor involvement*
NORMATIVE	*Exhibits professionalisation through involvement of clinical and NHS IT professionals*		*Professionalisation – involvement of academic computer scientists vs. commercial IT vendors*	*Professionalisation – involvement of IT technical consultants (not clinical involvement)*
COERCIVE	*Operates under NHS Scotland regulations*	**emulate the structures of a neutral and impartial body to support a competitive market in response to government regulations**		**Opaque procedures and restricted membership to abide by NHS strict confidentiality regulations** **Compulsory adoption**
Organisation	***Homogeneity through embeddedness in the users' organisational field***	***Homogeneity through embeddedness in the standardisation field***	***Heterogeneity through multiplicity of institutional fields***	***Heterogeneity through conflicting institutional fields***

Legend:

Bold: isomorphism with the standardisation field

Italic: isomorphism with the users' organisational field

Homogeneity and heterogeneity can be defined in terms of similarities and differences either between the standardization field and the adoption context or between the various adoption contexts in which a particular standard might be embedded. Heterogeneity or homogeneity in PSCs can thus be explained by examining organizational reactions to institutional pressures arising from the standardization and adoption contexts.

 (1) Homogeneity, or isomorphism, arises because of mimetic, coercive or normative pressures that lead to conformity of an emergent PSC with institutionalised features either within the standardisation field or within one or more adoption fields. Consequently, homogeneity in PSCs can manifest through the embeddedness of a PSC within either the standardisation field or the adoption domain. Isomorphism can be explained through the three types of institutional mechanisms described by Di Maggio and Powell (1983). For example, in the case of heavily regulated industries, governmental pressures for neutral standardisation processes to ensure viable, competitive, markets may force dominant players to form a PSC that emulates the behaviour of SDOs, as has been illustrated by the Origo case study.. Mimetic pressures may also force emergent PSCs to model themselves on existing organisations within the users' organisational context. For example, in vertical PSCs the users that drive the standard development process model the PSC on existing organisations, within their own environment, which best reflect their expectations and assumptions. This was seen in the case of the XML Steering Group in Scotland, where the group modelled itself on the existing NHS environment.

(2) Heterogeneity results from the multiplicity of institutional fields within which PSCs operate, either because of tensions and competing goals within

institutional fields between the demands of standardisation field and the users' organisational fields, or because of a multiplicity of organizational fields within the users' organisational domain itself. The former is more common in the case of industry specific organisations such as HL7 UK where significant but divergent institutional pressures co-exist for conformity with both the users' organisational field (NHS England) and the standardisation field (HL7). These lead to tensions and conflicts within HL7 UK and explain its heterogeneity. The latter can appear in the case of cross-industry PSCs which involve members from diverse and highly institutionalised organizational fields. For example, the Grid involves a variety of users organisational fields (academic and commercial) which push for heterogeneity in the PSC developed to conform to these different institutional fields.

The extent of homogeneity/heterogeneity is likely to vary depending on the stage reached by the standardization process. Early in the standardization process the emphasis is on standards *development*, rather than adoption, as participants focus on the defining characteristics of future standards. At this stage, in a drive for legitimacy through emulating tried and tested practices in standardisation, PSCs exhibit a strong element of isomorphism with other PSCs. Consequently, PSCs might be expected to exhibit a strong degree of homogeneity with the standardization field. As the emphasis of the standardization effort moves towards *adoption* and users become more involved in the standardization activity the dynamic adjusts so that the degree of homogeneity with a single adoption field, or with multiple fields if there is a strong element of homogeneity between adoption contexts, increases. Vertical standards consortia are exposed to the standardisation organisational field, but they are also influenced by the field

around their sectors, in particular existing institutions of inter-sectoral co-ordination and the institutionalised links between IT users and IT suppliers.

The four cases exhibited varying levels of organisational formalisation, from Origo employing its own staff to NHS Scotland, a looser, more informal co-operation between interested actors. The degree of formalisation was influenced by the scope of initial activities, with Origo established to develop a sectoral trading platform, and by the breadth of organisational diversity being reconciled; HL7 has developed a more bureaucratic standards development process than NHS Scotland due to the wider range of requirements and larger community of interested actors involved in the former. Similarly the processes of Grid standardisation became more formalised as the community of interested actors grew.

The resources exploited to simplify standardisation also influence the standardisation process. By basing the English NHS health standardisation process on HL7, an existing global standardisation process, the complexity of negotiating standards may have been reduced, but it ties the English body into the wider global processes, creating pressures to adopt their procedures. Similarly Grid standardisation draws on wider Web standardisation, notably within Oasis, but this creates pressure for their processes to align with this wider community. Furthermore, this process of isomorphism is not just retrospective but is also prospective: the processes in NHS Scotland were increasingly being influenced by the realisation that because of the relative sizes of Scotland and England and the influence of software suppliers their processes would progressively converge with HL7 UK.

The diversity of PSCs exists because organizations have different standardisation needs and, faced with a range of organizational structures, choose the structure which best satisfies their requirements. These requirements include, for example, the ability of member firms to influence decision-making or to exclude competitors from the process. This ability depends on the procedures governing PSCs (Austin and Milner, 2001). Consequently, PSCs adopt the form that best serves the specific needs of their members.

Conclusions and future research

This paper has examined the sources of heterogeneity and homogeneity for IT standard setting bodies through the lens of institutional theory. The study has demonstrated two divergent trends that characterise the current IT standardisation landscape:

Heterogeneity in standard bodies is explained based on (1) the emergence of hybrid organisations as a result of ongoing tensions between the institutional environments in which standardisation and adoption take place; and (2) a multiplicity of PSCs that result from different institutional environments and which characterise the users' organisational field and reflect the different institutional norms shaping the standardisation field. Homogeneity in standard bodies is explained based on (1) the embeddedness of PSCs in the users' institutional environment in order to legitimize the standardisation process through direct end-user involvement in the process; and (2) the embeddedness of PSCs in the standardisation field in order to legitimate the standardisation process within the adopting community through strict adherence to the SDO's technocratic principle. The extent of heterogeneity and homogeneity is a matter of degree rather than fixed/given characteristics. The degree of

homogeneity/heterogeneity of a particular PSC with its standardisation/adoption field is likely to vary depending on the stage of the standardisation process reached by the IT whose standardisation is addressed by that particular PSC as well as on the particular needs of the IT standard users.

There are two major contributions that this study brings to the research on institutional theory in a technical environment. We explain both similarity *and* diversity in organizational forms. In each of the four cases, heterogeneity and homogeneity have been shown to be the result of institutional forces impinging on the standard setting context.

First, the study extends both Lounsbury's (1996) and Hoffman's (2001) works, which look at the role that institutional environment plays in explaining organisational diversity. Heterogeneity in organisational forms is explained based on the multiplicity of institutional fields in which organisations operate. We have illustrated the conflicting and complex set of institutional norms that characterise the standardisation field, leading to different organisational responses. The study thus addresses the major criticism of institutional theory by extending the institutional framework to explain diversity in organisational forms.

Second, the paper adds to the IT standardisation research concerning the factors shaping the emergence of standard organisations (David and Shurmer, 1996; Hawkins, 1999; Werle, 2001). The study clarifies the institutional mechanisms which account for the recent changes in the IT standardisation landscape, and explains the range of environmental factors shaping the emergence of PSCs.

The case study design has allowed us to study, in depth, the emergence of PSCs within the standardization and adoption contexts (Creswell, 1994) and to explore the range of forces that influence the organizational nature of such PSCs. To obtain this detailed picture, a generic overview of the IT standardisation landscape has had to be sacrificed. Consequently, further research should involve a quantitative study addressing the emergence of PSCs and should extend the study to include formal SDOs. Further work is needed to map the standardisation domain in order to identify the degree of homogeneity and heterogeneity in the field.

Reference list

ABI (2004). *UK Insurance. Key Facts*, London: ABI, p. 6.

Aitchison, P. and Stone, M. (2002). 'The impact of e-commerce on UK financial service product providers and their intermediary relationships', *Pensions: An International Journal,* **8**, 1, 63-78.

Austin, M. T. and Milner, H. V. (2001). 'Strategies of European standardisation', *Journal of European Public Policy,* **8**, 3, 411-431.

Avergerou, C. (2000). 'IT and Organizational Change: an Institutionalist Perspective', *Information Technology and People,* **13**, 4, 234 – 262.

Baker M. (2004). 'Ian Foster on recent changes in the Grid community', *IEEE Distributed Systems Online,* **5**, 4, http://dsonline.computer.org

Baum, J. A. C. and Oliver, C. (1992). 'Institutional embeddedness and the dynamics of organisational populations', *American Sociological Review,* **57**, 4, 540-559.

Benson, J. K. (1975). 'The interorganisational network as a political economy', *Administrative Science Quarterly,* **20**, 2, 229-249.

Bunduchi, R., Graham, I., Smart, A. and Williams, R. (2005). 'The tensions shaping the emergence of standard bodies: The case of a national health informatics standard standards body',

Prometheus, **23**, 2, 149-166.

Butler, T. (2003) 'An Institutional Perspective on Developing and Implementing Intranet- and Internet-based Information Systems' , *Information Systems Journal*, 13, 209-231.

Chatterjee, D., Grwel, R. and Sambamurthy, V. (2002) 'Shaping Up for E-Commerce: Institutional Enablers of the Organizational Assimilation of Web Technologies', *MIS Quarterly*, **26**, 2, 65 – 89.

Child, J. (1972). 'Organisation structure, environment, and performance: The role of strategic choice'. Sociology, **6**, 1, 1-22.

Choi B., Raghu T. and Vinze A (2004) 'Addressing a standards creation process: a focus on ebXML' International Journal of Human-Computer Studies **61** (5) 627 - 648

Creswell, J. W. (1994). *Research Design. Qualitative & Quantitative Approaches,* Thousand Oaks: Sage.

Dacin, T., Goodstein, J. and Scott, W. R. (2002). 'Institutional Theory and Institutional Change', *Academy of Management Journal,* **45**, 1, 45-57.

David, P. A. and Shurmer, M. (1996). 'Formal standards-setting for global telecommunications and information services. Towards an institutional regime transformation?' *Telecommunications Policy,* **20**, 10, 789-815.

DiMaggio, P. J. and Anheier, H. K. (1990). 'The Sociology of Nonprofit Organizations and Sectors', *Annual Review of Sociology,* **16**, 137-159.

DiMaggio, P. J. and Powell, W. W. (1983). 'The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields', *American Sociological Review,* **48**, 2, 147-160.

Farrell, J. and Saloner, G. (1988). 'Coordination Through Committees and Markets', *The RAND Journal of Economics,* **19**, 2, 235-252.

Graham, I., Spinardi, G., Williams, R. and Webster, J. (1995) 'The Dynamics of EDI Standards Development' *Technology Analysis and Strategic Management* **7** (1) 3 - 20

Greenwood, R. and Hinings, C. R. (1996). 'Understanding radical organisational change: bringing

together the old and the new institutionalism', *The Academy of Management Review,* **21**, 4, 1022-1054.

Hanseth, O., Jacucci, E., Grisot, M. and Aanestad, M. (2006) 'Reflexive Standardisation', *MIS Quarterly*, **30**, 563-581.

Hawkins, R. (1999). 'The rise of consortia in the information and communication technology industries: emerging implications for policy', *Telecommunications Policy,* **23**, 2, 159-173.

Hoffman, A. J. (2001). 'Linking organizational and field-level analyses', *Organization & Environment,* **14**, 2, 133-156.

Jakobs, K. (2000). *User participation in standardization processes - impact, problems and benefits,* Vieweg Publishers.

King, J. L., Gurbaxani, V., Kraemer, K. L., Warren McFarlan, F, Raman, K. S. and Yap, C. S. (1994) 'Institutional Factors in Information Technology Innovation', *Information Systems Research*, **5**, 2, 139 – 169.

Lawrence, T. B. (1999). 'Institutional Strategy', *Journal of Management,* **25**, 2, 161-188.

Lounsbury, M. (1996). 'Garbage can institutionalism: Symbolic conflict and the inter0field diffusion of contending models'. Paper presented at the *Stanford Conference on Organizations*, Pacific Grove, CA.

Markus, M. L., Steinfield, C. W. and Wigand, R. T. (2003). The Evolution of Vertical IS Standards: Electronic Interchange Standards in the US Home Mortgage Industry, In King, J. L. and Lyytien, K. (Eds), *Proceeding of the Workshop on Standard Making: A Critical Research Frontier for Information Systems*, Seattle, 80-91.

Meyer, J. W. and Rowan, B. (1977). 'Institutionalized Organizations: Formal Structure as Myth and Ceremony', *The American Journal of Sociology,* **83**, 2, 340-363.

Miles, M. B. and Huberman, A. M. (1994). *Qualitative Data Analysis: An Expanded Sourcebook,* Thousand Oaks: Sage Publications.

Oliver, C. (1991). 'Strategic Responses to Institutional Processes', *Academy of Management Review,* **16**, 1, 145-179.

Oliver, C. (1992). 'The Antecedents of Deinstitutionalization', *Organization Studies*, **13**, 4, 563-588.

Orlikowski, W. and Barley, S. (2001) 'Technology and Institutions: What Can Research on Information Technology and Research on Organizations Learn From Each Other?', *MIS Quarterly*, **25**,2, 145-165.

Patton, M.Q. (1980) *Qualitative Evaluation Methods* Sage, London

Payne, S. (2000) 'Interview in qualitative research' in Memon A. and Bull R. (eds) *Handbook of the Psychology of Interviewing* pp 89 – 102, John Wiley and Sons, Chichester.

Schoechle, T. (2003). Digital Enclosure: The Privatization of Standards and Standardization, Paper presented at the *3rd IEEE Conference on Standardization and Innovation in Information Technology*, Technical University of Delft.

Scott, W. R. (1991). 'Unpacking institutional arguments'. In Powell, W. and DiMaggio, P. (Eds) *The new institutionalism in organisational analysis*. Chicago: University of Chicago Press 164-182.

Stake, R. E. (1995). *The Art of Case Study Research*, USA: Sage Publications.

Walsham, G. (1993). *Interpreting Information Systems in Organisations*, Chichester: John Wiley.

Werle, R. (2001). 'Institutional aspects of standardization - jurisdictional conflicts and the choice of standardization organizations', *Journal of European Public Policy*, **8**, 3, 392-410.

Zucker, L. G. (1987). 'Institutional Theories of Organization', *Annual Review of Sociology*, **13**, 1987, 443-464.

Web sites:

1. SIIT list: siit@i4mail.informatik.rwth-aachen.de, discussion thread started on 9th of February, 2005

2. http://www.mcell.cnl.salk.edu/

3. http://www.neesgrid.org/index.php

4. http://www.show.scot.nhs.uk/sci/products/products.htm, Accessed on 7th of April, 2005

© Bunduchi, R., Graham, I., Smart, A., & Williams, R. (2008). Homogeneity and heterogeneity in information technology private standard settings - the institutional account. Technology Analysis and Strategic Management, 20(4), 389-407doi: 10.1080/09537320802141387

5. http://www.ud.com/rescenter/files/cs_gsk.pdf