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Abstract

This paper explores how national Electronic Patient Record (EPR) systems are customized in local settings and, in particular, how the context of their origin plays out with the context of their use. It shows how representations of healthcare organizations and of local clinical practice are built into EPR systems within a complex context whereby different stakeholder groups negotiate to produce an EPR package that aims to meet both local and generic needs. The paper draws from research into the implementation of the National Care Record Service, a part of the National Programme for Information Technology (NPfIT), in the English National Health Service (NHS). The paper makes two arguments. First, customization of national EPR is a distributed process that involves cycles of 'translation', which span across geographical, cultural and professional boundaries. Second, 'translation' is an inherently political process during which hybrid technology gets consolidated. The paper concludes, that hybrid technology opens up possibilities for standardization of healthcare.

Keywords: *UK, translation, hybridity, customization, EPR, technology, healthcare*

Introduction

Electronic Patient Record (EPR) systems can be developed within and by healthcare organizations or, more commonly, they can be bought as generic software products (Davidson & Chiasson, 2005; Greenhalgh et al., 2009; Sawyer, 2000; Williams & Pollock, 2008). The latter give clients the chance to get software that embodies 'best practices' and also standards such as technical, procedural, output oriented and terminological that enable coordination, prescribe work and provide a shared language that allows consistency of the messages being exchanged (Boulus & Bjorn, 2010; Brunsson et al., 2012; Hanseth et al., 2006; Hanseth & Lundberg, 2001; Timmermans & Berg, 2003; Timmermans & Epstein, 2010; Wagner & Newell, 2004; Yeow & Sia, 2008). Homegrown EPR systems are developed to the needs of a healthcare organization. Software packages are designed to a market, not to a client, requiring further adaptation (customization) to local needs (Williams & Pollock, 2008).

Customization cuts across the locale where EPR is designed and the locale where it is adopted and put into use. There is a substantial body of literature from Information Systems and Science and Technology Studies (STS) that discusses the outcomes, and to some extent the process, of EPR implementations at a local or national level (Brunsson et al., 2012; Davidson & Chiasson, 2005; Greenhalgh et al., 2008; Håland, 2012; Hanseth et al., 2006; Hanseth & Lundberg, 2001; Kallinikos, 2010; Jones, 2003; Lapointe & Rivard, 2005; Oborn et al., 2011; Pollock et al., 2003; Vikkelsø, 2005; Williams & Pollock, 2008). In most studies customization of EPR is presented as being confined to a single organization, the user, with other stakeholders, such as developers and suppliers, being external to it (Boulus & Bjorn, 2010; Oborn et al.,

2011). In this paper we illustrate that the boundaries around EPR customization are dispersed and show how the context of origin of an EPR plays out with the context of its use and its implications.

This paper presents findings from research into the implementation of the National Care Record Service (NCRS), a part of the NPfIT, into an English hospital. It aims to explore how representations of local healthcare organizations and clinical practice are built into EPR systems during the process of customization and within a complex context whereby different stakeholder groups (service provider, software developers, healthcare professionals, governmental organizations etc.) negotiate to produce an EPR package that aims to meet both local and generic needs. It contributes in two ways to the studies that examine the politics that emerge during health technology adaptation taking an STS perspective. First, it shows that customization of health technology is not confined to a single locale but is a distributed process that involves cycles of translation. The latter may span across geographical, cultural and professional boundaries. Second, it demonstrates that translation is an inherently political process during which a hybrid technology becomes consolidated. The paper argues that translation and hybridity are co-constitutive and concludes that hybrid technology could open up possibilities for standardization of healthcare.

The Politics Of EPR Customization: Translation & Hybridity

Implementation of EPR is often accompanied by local interventions to accommodate it to everyday work practices. Customization, one of these interventions, implies making extensive changes in the code of the system and redesigning some of its features so that it becomes contextualised to the implementer health organization (Bjørn et al., 2009; Davidson & Chiasson, 2005; Davidson & Chismar, 2007; Oborn et al., 2011; Williams & Pollock, 2008). Although necessary, customization is often

limited as the software's embodied logic cannot be easily fine-tuned (Kallinikos, 2010) and because of the power IT suppliers exercise, through invocation of their technical expertise, to minimise changes in the provided software (Hislop, 2002). It is typical for example for software developers and suppliers to prioritize the technical expertise incorporated in software over its usability when implemented in a specific organizational context (Sawyer, 2000; Wagner & Newell, 2004). This largely emerges because of the distance, physical and literal, between software developers and end users. Typically, standard EPR products are developed either in isolation from the user or in line with the requirements and the needs of a few organizations only, usually the largest, more profitable and innovative, compromising in either case their malleability (Pollock et al., 2003; Scott & Kaindl, 2000; Timmermans & Berg, 2003). Inevitably, conflicting goals and power plays emerge between software developers and user organizations as they negotiate how to customize an EPR and which of its embodied 'best practices' are actually 'best' for the user organization (Davidson & Chiasson, 2005; Oborn et al., 2011; Wagner & Newell, 2004; Yeow & Sia, 2008). Bjørn et al. (2009) have shown that negotiations between stakeholders are necessary before deciding on the elements of a health technology that can be standardized and used across contexts and those that need to remain local. Negotiations between different groups of the same organization have also been reported as being essential to EPR adaptation (Boulus & Bjorn, 2010; Oborn et al., 2011). This is because the monolithic culture of EPR, expressed through its embodied standards, contradicts the multiple local cultures that exist within a healthcare organization (e.g. clinical/medical work, nursing work, administrative work) (Ellingsen & Monteiro, 2003; Wagner & Newell, 2004).

EPR's adoption brings about changes into the organization of healthcare professional work, for example changes in roles, tasks, skills, modes of collaboration and may reinforce trends towards rationalization of medical work and diminished clinical discretion (Berg, 1997; Boulus & Bjorn, 2010; Davidson & Chismar, 2007; Vikkelsø, 2005). It is doubtful however that EPR can attain absolute standardization of work (Ellingsen & Monteiro, 2008). The level and extent of changes EPR may reinforce are influenced by healthcare professionals' views on how EPR aligns with their professional identity (e.g. their status, relationship with patients etc.) and how it impacts on their routines (Jensen & Aanestad, 2006; Jensen & Kjaergaard, 2010).

A study conducted by Timmermans and Berg (1997) on the introduction of two clinical protocols in hospitals has shown that the imposition of standards (in their case of clinical protocols but this also applies to standards embodied in health IT) does not necessarily impose new structures, roles and processes on clinical staff; neither however leaves them intact. Standards incorporate existing routines, power configurations and cultural traditions and simultaneously transform them achieving in this way 'local universality'.

Following this line of argument we show that 'local universality' could be attained if we consider how technology becomes translated across boundaries, consolidating hybrid technology, and what opportunities this opens up for standardization of healthcare. We understand customization as a process of 'translation'. Originating from the 'sociology of translation' (Callon, 1986) translation implies displacement for instance in space, in language, in form or in power (Callon, 1986; Czarniawska & Sevon, 2005; Latour, 1987). In his seminal work Callon (1986) has shown that translation is a process of creating a network of aligned actors (both human and non-human beings), which is, ideally, characterised by consensus and common interests. A

political process precedes consensus whereby different actors become docile in order to meet the purposes of the network, which is typically led by a spokesperson (Callon, 1986; Star, 1991). We are interested in studying the politics of translation but we take the latter as being a highly distributed process, not confined to the limits of a loose network, whereby different stakeholders negotiate in order to meet their own ends (Star, 1991; Strathern, 1991; Timmermans & Berg, 2003). We see translation as being a polemic process not necessarily leading to consensus or harmony let alone to durability, as Callon's paper also illustrates (Strathern, 1991).

The central idea behind translation is that human beings, technologies and interests are not simply 'transferred' across temporal and spatial boundaries; neither do they remain intact, as if they had a predetermined destiny (Callon, 1986; Latour, 1988, 2007; Jensen & Winthereik, 2002). Rather as they are being transferred they simultaneously get translated and transformed. Translation has a material (embodied) nature (Czarniawska & Sevon, 2005, p.9) for it is made possible through the implication of devices. These enable ideas to travel across boundaries by lifting them up from their context (dis-embeddedness), by inscribing or embodying them into a material artefact (objectification) and by allowing them to become appropriated and make sense to different other settings (re-embededdness) (Czarniawska & Sevon, 2005). This is an iterative process of in-scriptions and de-scriptions (Timmermans & Berg, 1997), which allows new ideas to be produced and reproduced as they travel across boundaries. Sociologists see translation as being primarily a process; we are interested in this paper in also finding out what becomes consolidated (even temporarily) in the process of translation, namely hybrids.

A major debate in the literature on hybridity concerns their nature and origins. Some suggest that hybridity is a combination of existing entities that are typically found

separately (Battilana & Dorado, 2010; Bloomfield & Hayes, 2009; Miller et al., 2008). Metaphors such as 'layered hybridity' and 'grafted hybridity' have been used to illustrate hybridity as a process of bringing together different elements in varied ways (Bloomfield & Hayes, 2009). Other authors argue that hybridity is the construction of a new entity that reflects the entities, which it comes from (e.g. spaces, stakeholders etc.) but is not identical to them (Rutherford, 1998). Hybrids constitute the production of something new. The first definition looks mostly into the production of hybrids whereas the second focuses on the product (the hybrid). In our paper we go beyond this distinction showing that EPR is a hybrid technology that becomes consolidated, even if temporarily, amidst a complex customization process.

Hybrids are heterogeneous and political in as long as they emerge from negotiation and struggle between pre-existing entities (Pieterse, 2001; Shimoni & Bergmann, 2006). As Haraway (1991) suggests hybrids constitute a polemic against well-established dichotomies such as human-animal; organism-machine; physical-non-physical. They are a manifestation of fragmented identities and of the impossibility of being a unified One. Hybridity is central to the sociology of translation (Strathern, 1991). According to sociology of translation, we need to move away from constructed dualisms such as social versus technical or human versus non-human towards a view that sees any being, such as an EPR, as a hybrid (Latour, 1993; Strathern, 1991). That is as an outcome of a series of translations that have occurred over time and space and have involved various beings. Indeed, Latour (1987, p 267) defines translation as '*modification, deflections, betrayals, additions and appropriations that displace subjects and objects into someone or something otherwise*'. This 'other' is a result of translation and constitutes a hybrid. Generally, the relevance of the sociology of translation to the study of hybridity has been recognised in the literature (Brigham &

Hayes, 2013) and has been supported by a rising interest in the role of technology in hybridity (Bloomfield & Hayes, 2009). It is to this growing literature our paper seeks to contribute by exploring how the 'translation' of EPR – during its local adaptability - conditions hybridity and the possibilities hybridity opens up for standardization of healthcare.

The Context of the Study

The findings we present here are part of a larger study of the evaluation of the NCRS implementation in the NHS in England (Klecun et al., 2014; Robertson et al., 2010; Sheikh et al., 2011; Takian et al., 2012), which was launched in 2002 by the Department of Health (DH). The NCRS was envisaged as an electronic patient record to be shared across hospitals in the English NHS (DH, 2006). A multidisciplinary team from four UK universities conducted the study. Each university team studied a number of secondary healthcare organizations (Acute Trusts (hospitals), Mental Health Trusts and Community Hospitals), 12 in total. These organizations were chosen because they had begun implementing or would start implementing the NCRS during our evaluation. In this paper we present findings from our team's study of one Acute Trust, which for anonymity purposes, we name here Alpha. In 2008 Alpha was one of the first hospitals to implement the NCRS system; we could thus conduct a longitudinal study, following the NCRS implementation and customization over a 13-month period.

A number of stakeholders were involved in customization such as a multinational software house that developed the system; a consultancy that provided implementation services to Alpha, from now on the Local Service Provider (LSP); Connecting for Health (CfH), a directorate of DH responsible for overseeing the implementation of the NCRS at national level and Alpha's implementation team (See

figure 1). The latter consisted managers (programme, project, IT etc.) and healthcare professionals (senior and junior doctors, nurses, matrons etc.). Some of the managers were contracted to deliver their services for a specific period of time, lacking NHS experience; others were permanent members of the hospital. Healthcare professionals were working in Alpha well before the commencement of the NCRS.

<Figure 1 here>

The NCRS was designed and developed in line with specifications that were set centrally by CfH and the LSP and agreed in a contract. The LSP was also in a contractual relation with the software house. Both the LSP and the software house had vested interest in the timely delivery of the NCRS, as they were paid upon use and sign off by the hospital, and were committed to their contractual obligations. Although the hospital was the user of the NCRS it was not in a contractual relation with any of the involved stakeholders and remained accountable only to the DH. Hospital Alpha followed a small-scale approach to the implementation of the NCRS system. The system went live in March 2009 in the Radiology and Orthopaedic departments, clinics and wards and was mainly used for electronic ordering, transferring and reporting of X-Ray requests and results and for other relevant supporting processes such as electronic viewing, re-ordering and cancelling of requests.

Research methodology

Our study aimed to explore how customization of the NCRS was carried out as it travelled across a range of stakeholders. It was focused on the politics of technology's adaptation. Although, technology plays a core role as a bearer of politics, this paper gives prioritization to human agency, and specifically to stakeholders' interests and considerations as they inscribe their interests and intentions into the technology

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(Fuller, 2000). To meet this aim we conducted qualitative study following an interpretive epistemology (Crotty, 1998). Our interpretive study reconstructs the process of translation by showing its embedded politics whilst considering the socially and culturally shaped context in which translation is situated.

We gathered information through semi-structured interviews and documents. We conducted 28 interviews in total in two periods. The first period was between May and August 2009, a few months after the implementation of the NCRS started, and the second period was between March and June 2010. These research periods were negotiated and mutually agreed between the researcher and the Chief Information Officer and Programme Manager from Alpha. Interviewees included project managers (3), training manager (1), programme managers (3), product specialist (1), IT manager (1), configuration architect (1), testing lead (1), business analyst (1), business change leads (2), doctors (4) and nurses (6). Of these interviews seven were conducted with implementation team members in the first period. Sixteen interviews were conducted in the second period when the number of users had increased and the Trust had taken its implementation further. Interviews with CfH (2), LSP (1) and software house (2) were also conducted. Apart from a phone interview, all other interviews were conducted in person, were, with a few exceptions, recorded, lasted between 30 and 90 minutes and were transcribed verbatim.

Interviewees from each stakeholder group were selected purposively, depending on their role and involvement in the implementation of the NCRS, and also in a snowball manner based on recommendations from previous interviewees. Due to the small scale of implementation of the NCRS there was similarly a small number of users.

For our interviews we used thematic guides for each stakeholder group. Our research was designed and conducted according to NHS research governance frameworks and

was approved by an NHS Research Ethics Committee. We received informed consent from all participants.

We did not 'follow the actors', as Callon's (1986) translation model would typically require, for when we started our fieldwork a network, loosely defined, was already formed so the process of translation could not be fully accounted (Strathern, 1991). Also, as researchers we had to make decisions as to who can be included and who is unavoidably excluded from our research. For instance, we interviewed those designers who travelled to England for a period of time to work together with Alpha but left outside of our study those developers who were based in India. We tell a story on the basis of those decisions, accepting in this way that it could be told in many other ways (Haraway, 1991; Singleton & Michael, 1993; Star, 1991).

We analysed our findings manually following a thematic process informed by relevant literature and fieldwork (Strauss, 1987). We followed an inductive approach to analysis whereby we made systematic readings of our interview transcripts and field notes and then compared and contrasted them with the literature leading to the creation of themes and sub-themes (Alvesson & Skoldberg, 2000). We initially created several themes (e.g. implementation; technology-in-use; customization; power and resistance etc.), which were then elaborated, developed and refined to reflect the purposes of this paper. Some of the themes that guided our analysis were customization process; collaboration across boundaries; politics and negotiations and instances of translation. To ensure coherence of data analysis, our analytical themes were discussed between the authors and then presented within the larger project team for further elaboration. The sections that follow present our findings and analysis.

'Translating' the NCRS in Alpha

A key characteristic of NCRS was its centralized character manifested, as we described, by the number of contractual relations developed between stakeholders. Alpha's implementation team believed that LSP's priority was to make the NCRS go live timely independently of its appropriateness, quality and durability. This was reflected in the contracts that were signed between CfH and LSP and LSP and software house, which were directed towards outcomes (delivery) but not primarily quality. As we said above, Alpha lacked direct communication and contractual relation with software developers and thus was not seen as being the immediate client of any of the involved stakeholders despite the fact that they had to sign off the NCRS use.

> '*We are being pressured [by the LSP and CfH] into accepting suboptimal things and they are being pressured to develop and deliver suboptimal products just because of the type of pressure that they are under*' (Consultant orthopaedist, Alpha).
>
> '*I think that's what drives some of the frustration probably from both parties sitting at the far end is, you know, if we can't engage with the customer how do we know we're delivering something that's going to be beneficial ... because you've not got that direct communication the frustration increases*'
>
> (Software developer)

The creation of a chain of contracts made it difficult to create a 'fit for purpose' EPR system and conditioned opportunities for back-pushing and fragmented responsibility. As an IT manager from CfH said it was hard to identify who was responsible for a user-unfriendly design: CfH who created the specification; the LSP who oversaw the implementation or software developers who designed the system? Different people had different views about those questions, as becomes more obvious below, and

complexity increased if one considers geographical aspects that became profound in NCRS implementation. The NCRS system designers were based in India and had limited, if any, knowledge of how the NHS in England is structured and how it works. As a result, they developed software that was technically compliant with CfH's specifications but lacked clinical relevance. Alpha's implementation team and CfH both believed that English presence from software developers was necessary to expedite changes in the system in a timely manner.

> '...*the problem is that they* [software developers] *are not healthcare workers and they haven't had that feel of healthcare ... I don't know if India have an NHS service like we do, so they probably wouldn't understand that either. It would be a lot easier if they had an understanding of how health organization practices worked'* (Configuration architect, Alpha).

When the hospital's implementation team embarked on the adoption of the NCRS they expected it to be 'fit-for-purpose', requiring minimum amendments before its use. In practice, however, the NCRS system had to be extensively adapted before being adopted. Managers from the implementation team shadowed healthcare professionals in Radiology and Orthopaedics so that they could then represent clinical work onto the NCRS.

> '*they* [i.e. managers from the implementation team] *came in to do a process mapping as to how our processes worked and how our systems worked and what parts of the process could be electronified, if you like, and then went away and tried to reproduce our pathways and processes in an electronic format'* (Consultant orthopaedist, Alpha).

During customization hospital managers found out that protocols and standard operation procedures did not really reflect local practice and they '…*didn't really*

know to the level of detail what it is people were doing …' (Project manager). For instance, they reported that they encountered clinical practices they could not understand (e.g. blood-pressure taken five times in a pathway), workarounds, which they understood, but did not know whether (or not) they should be mapped (e.g. smartcards left in the terminals to treat patients) and highly varied clinical and business processes. Customization was thus carried out by trial and error with managers leaving outside of their scope those practices that did not drive clinical work.

Healthcare professionals from the implementation team were also involved in customization and specifically in the redesign of clinical forms and in mapping clinical processes. Their role was two-fold. First, they had to identify the information that needs to be captured and the necessary tasks that need to be carried out for each clinical pathway. Second, they had to adjust the central specification, on the basis of which the NCRS was developed, to their own clinical work. This entailed interpreting and translating the content of the initial specification to clinical language and then clinical practice to computer jargon as often design varied from practice.

> *'we [Alpha] do struggle sometimes with interpretation of how they [CfH, LSP, software house] deem a design and how we deem a design. … it is quite a hard struggle with a lot of the other external organizations to try and communicate our point.'* (Configuration architect, Alpha).

For example initial design of the NCRS rendered orthopaedists personally responsible for authorising X-Ray tests for female patients at childbearing age (as defined by the system). This task was previously a shared responsibility between clinicians and, mostly, radiologists. It also prohibited radiologists from adding additional pieces of information to an X-Ray request form; a typical practice under the paper-system.

Further, the NCRS kept track of all the changes made to a document without making them apparent. Healthcare professionals would have to look for any changes manually. These were some of the key items in the customization agenda that conditioned negotiations and politics.

The politics of customization

Customization was carried out through an 'Issue Management Process' (IMP). Initiated by the LSP, the IMP was a central process of maintaining a log of problems of the system. The hospital raised 940 issues within the first three months from its go-live date and 1,400 issues within its first year of implementation. Issues emerged during both the testing and the use of the system and were reported to the Trust's IT Helpdesk by users and then to the LSP's Service Desk. The implementation team ranked the severity of the raised issues, collected by the Trust's IT Helpdesk, and prioritized them in terms of their importance taking into consideration clinical safety issues, number of users affected and potential media interest. Once received the LSP would also prioritize the issues raised in terms of whether they were fixable (or not) and whether they required a change in the code (or not) and the type of change required. These issues were then discussed in web-conferences with all stakeholders involved where they would negotiate about the resolution of the raised issues.

Alpha's implementation team argued that the stage of implementation influenced the prioritization of the issues a hospital raised. For example the 'Go live' stage was perceived as a critical stage whereby any emerging issues were prioritized whereas other issues that emerged pre and post-'Go-live' were given less importance.

As a programme manager at Alpha said CfH and LSP aimed to maintain the '*design ethos*' of the software so that it could be used across hospitals independently of local

needs. According to software developers the NCRS system was configurable but in the light of the NPfIT the system needed to be standardized.

'you don't want to create a bespoke product either so, you know, you could make something for [name of a hospital]*, that they've got some very specific processes that then you couldn't roll it out anywhere else so you have got to be a little bit careful'* (Software developer)

Some adaptations were however made in NCRS after negotiations. These however did not always meet the hospital's requirements. For example, when the implementation team asked for X-Ray requests to be generated by the system automatically the updated functionality allowed repeat requests automatically populated with the information (demographic and clinical) that was inputted last time. Radiologists were concerned about the risks this would entail but decided to work around this functionality. A consultant attributed this discrepancy to different interpretations between the hospital, the LSP and the software developer.

'…A lot of the things that have been produced that we've asked to use are not what we actually asked for. They are their perceptions of what the solution would be.' (Consultant orthopaedist, Alpha).

Software developers were checking the NCRS's compliance with the specification and declined required changes on the grounds that the software works as designed. Alpha was not in agreement with the specification and the subsequent initial design, which brought a lot of frustration. A healthcare professional reported that Alpha had 'to fight for every single change' before issues were prioritized and resolved. This was largely because of the lack of 'contractual muscle', as a senior manager said, to demand direct changes to be made in the system. One of the most effective, and for some the single, way to negotiate change was to claim that the software raised clinical

safety issues and, on this basis, to stop using it. This was for instance the case of digital images which when re-opened would lose all the work doctors did on them (e.g. marking, annotating etc.). Generally, it was acknowledged that by raising clinical safety issues healthcare professionals could exercise power and even bring the NCRS implementation to a halt.

'*The only control we have is to say, stop, this is unsafe. And that's really the only control we have. That makes them jump. They will do things*' (Consultant radiologist, Alpha).

Software developers argued that the politics of customization were conditioned on the ethos of the NHS, which they described as being about the power of the institution to resist changes in its structure and function and to work towards the maintenance of its status quo. Software developers also made reference to the power clinicians had to bring NHS programmes of reform to a halt by invoking their clinical expertise and as the final users of the NCRS to demand changes before going live.

'*…you always get into the "I'm not going live unless you do this for me" so regardless of the original intention the Trust always have the supplier over a barrel… this goes back to the ethos of the NHS, they don't like to be told what to do… you could spend another 10 years trying to find something that you can get two clinicians to agree on*' (Software developer)

As of December 2010, when the implementation should have been finalized, Alpha went live with limited functionality of the NCRS system (electronic ordering and reporting of X-Ray requests; uploading VT assessments; digitalization of documents). After the dismantling of the NPfIT, the digitalisation of the English NHS evolved towards a more local procurement and implementation. Alpha continued its own EPR

strategy, outside a national programme, but despite progress it has yet to implement a hospital-wide EPR.

Discussion

The case of Alpha illustrates the politics that emerge when a national EPR becomes customized. In this section we discuss two points. First, that translation occurs during local adaptation of technology and as the context of technology's origin plays out with the context of its use. To do so we discuss the different boundaries that condition translation. Second, we argue that the process of translation consolidates hybrid technology, which partly reproduces and partly re-presents original intentions and designs. We believe that this provides an illustration of how 'local universality' is conditioned (Timmermans & Berg, 2003).

Our first point is that customization of a national EPR is not confined to a single locale such as a hospital but is a distributed process that occurs across geographical, cultural and professional boundaries. The NCRS travelled across space and cut across public and private sector mind-sets and across managerial and professional dichotomies. Its journey however was not smooth and neither did it follow a single trajectory; it was shaped by negotiations and politics that occurred between the different stakeholders. As technology travelled across those boundaries its embodied meaning became translated into something other than its original (Czarniawska & Sevon, 2005; Latour, 2007).

Customization of the NCRS occurred across spatial boundaries. It was specified by CfH in England and was developed in India. Even before it arrived in hospital Alpha the technology, in all its different forms, such as specification, design and software had undergone a number of translations with software developers interpreting the design into computer language. Its implementation in hospital Alpha required further

translations (Latour, 2007). Specifically, clinicians had to put initial builds of the system into clinical practice terms, in other words to 'de-scribe' or 'embed' them (Czarniawska, 2008; Timmermans & Berg, 1997), in order to make them meaningful for their work and context of use. We have shown for instance how clinicians' request for repeats X-Ray requests was interpreted by designers as repeat requests populated with inputted information. Clinicians had to explain why this functionality could entail risks and how it needed to change, following a process of 'inscription' or dis-embeddedness whereby clinicians translated clinical practice into a language that can then be codified (Czarniawska, 2008). This was not a one-off process but involved iterative cycles of translation as the NCRS travelled from software developers to Alpha's implementation team, and then through CfH and the LSP back to developers again (Czarniawska & Sevon, 2005). In doing so the NCRS was continuously (re-)interpreted and (re-)created. Translation seems to be unavoidable considering the distance that separates designers from users (Timmermans & Berg, 2003). This distance is not only literal- geographical but also metaphorical reflecting absence from local context and lack of awareness of its contingencies. We see this process of cycles of translation as being not a disruption to implementation but a basis for exchanging perspectives, an opportunity for reflecting on 'how things are done here' and a condition for coming to a consensus. Such process needs not to be avoided but accommodated, in terms of time and resources required during customization, in order to allow flexibility and to give space for negotiations, and, when necessary, for compromises.

Healthcare professionals played a key role in these cycles of translations. Their mediation expands and enriches the concept of 'clinical engagement', a commonly used term indicating the involvement of clinicians in the adoption of health IT

innovation. In our case, clinical engagement means active participation in adapting EPR to local context and, in practice, in its re-creation. It thus goes back to early theories on a socio-technical approach to IS development (Mumford, 2011). It also suggests an emerging hybrid role that clinicians undertook as both users and developers of the EPR (Millerand & Baker, 2010; Ramiller, 2005). Further, it indicates that the role of spokesperson is particularly challenging in the context of an EPR customization. The complexity of clinical work and the diversity of institutions and professional groups challenge the ability of a single actor to represent (translate and 'lock') their diverse interests. As our study has shown without active engagement of a range of stakeholders 'a network' is perhaps unlikely to stabilize.

Technology's translation also occurred across cultural boundaries and specifically across public (Alpha) and private sector (LSP, software developers) mentalities. These different organizations had different priorities with the LSP aiming to provide service in a fast and efficient manner whilst limiting any delays and costs whereas the implementer hospital was primarily interested in developing software that met clinical needs (Hanseth et al., 1996; Hislop, 2002; Sawyer, 2000). A key mechanism that allowed translation to occur was the issue management process. As we have shown this was a political process whereby prioritization was decided on the criticality of the implementation stage (the closer to the go live the more critical) rather than the severity of the raised issue. There was a general reluctance from the LSP side to approve extensive customization as this would modify the design ethos that underpins NCRS causing also delays in meeting their contractual obligations. It has been reported in the literature that software packages embody logic that cannot be easily modified (Kallinikos, 2010). Our case suggests that configurability was not a technical barrier but a political in that changes in the software impacted the

contractual relation suppliers had with CfH and were on this basis resisted. Ultimately the decision as to what is 'best' for a healthcare organisation to adopt and what is best to change is an outcome of negotiations (Bjørn et al., 2009; Oborn et al., 2011; Wagner & Newell, 2004).

As the NCRS was being customized it disrupted existing work cultures, bringing alterations in clinicians' practices and changes in the way in which jurisdictions were being divided between clinical groups (Berg, 1997; Boulus & Bjorn, 2010; Davidson & Chismar, 2007; Oborn et al., 2011). We have shown for instance that the NCRS system took away radiologists' right to input information to an X-Ray request form post-hoc. At the same time the NCRS was intended to reproduce and digitalise the existing work cultures and business processes rather than transform them radically.

The implementation of the NCRS also needed to cut across professional boundaries mainly healthcare professionals and IT developers. The case illustrated that each group intended to influence the degree and type of customization according to its interests. We have shown for instance how clinicians invoked their clinical expertise and specifically the discourse on 'clinical safety' to insist on changes made in the software and even stop the implementation. IT experts used their technical expertise to legitimize the NCRS design (Hislop, 2002). Their discourse 'works as designed' was powerful to obstruct EPR customization. These examples indicate how professional knowledge can be mobilized in order to frame customization (Berg et al., 2003; Timmermans & Berg, 2003) as professionals use it to exercise power over the extent and type of changes made in the software (Hislop, 2002; Nicholson & Sahay, 2004; Walsham, 2001). Professional knowledge was also a way to set boundaries over, the otherwise endless, process of translation. For instance, as we showed translation would stop when clinicians raised clinical safety concerns.

The second point our case illustrates concerns the hybrid nature of technology. Our findings suggest that hybridity does not emerge from a combination of two or more pre-existing entities (Battilana & Dorado, 2010; Bloomfield & Hayes, 2009) but from their translation. We have shown for instance that the NCRS was not a sum of the different perceptions stakeholders had of clinical knowledge and of the NHS but an amalgamation of their interpretation, translation and inscription into the NCRS. The NCRS became a hybrid technology in that it partly re-presented (presented anew) and partly reproduced stakeholders' interpretations (Rutherford, 1998).

Four instances of hybridity emerge from our study. First, the NCRS digitalised existing clinical practices except those Alpha's implementation team decided not to digitalise due to their limited importance. Second, the NCRS intervened into existing relations of power by re-distributing jurisdictions between radiologists and orthopaedists and by taking some jurisdictions away from radiologists. This was not a substantial transformation of existing power relations but a disruption to them (Timmermans & Berg, 1997). Third, it provided additional clinical functionality that under the paper system was not offered, for example the possibility for clinicians to work on digital images. Fourth, it offered visibility over changes that occurred in electronic clinical forms and documents and in this way enabled better electronic control. The NCRS was thus a hybrid technology in that it embodied existing practices, relations of power and modes of control (albeit slightly transformed) whilst adding new possibilities (albeit slightly adapted to fit the local context).

During customization actors' interests and requirements often compete and are not always (or indeed seem to be seldom) fully accommodated. The production of hybrid technology is not an outcome of a failed customization but a way of accommodating the competing interests of the involved stakeholders. Precisely because of its hybrid

nature, the NCRS, or indeed any hybrid technology, should not be judged against the initial design but rather against the way in which the initial design becomes adapted to the context of technology's use; not looking to the past but to the present and the future.

Our final argument is that hybrid technology opens up possibilities for standardization of healthcare. The distributed nature of customization suggests that EPR (and its embodied standards) becomes dissolved and changed as it goes through cycles of translation. We would thus expect its 'standardizability' to fade away. Translation however also suggests a process in which EPR (and its embodied standards) is neither adopted nor rejected per se but is continuously 'in-use' (i.e. under translation). Translation allows hybrid EPR to be produced and to make sense not only within but also across settings increasing in this way its possible 'standardizability' and thus also its 'local universality' (Timmermans & Berg, 1997). This shows the productive power of hybridity as it opens up space for creating IT innovations that may be meaningful to local healthcare settings. It also suggests that customization is not necessarily an obstacle for standardization but could be one of its conditions. This is largely depending on who is involved in the cycles of translation, how much influence they maintain within the network, what devices they employ, and importantly who makes decisions for their termination. The question therefore is not about the desirability of hybrid technology, this is often unavoidable in national EPR implementations, but about the politics of boundaries and the governance of technology's translation.

References

Alvesson, M. & Skoldberg, K. (2000) *Reflexive Methodology: New Vistas for Qualitative Research*. Sage Publications Ltd.

Battilana, J. & Dorado, S. (2010) Building Sustainable Hybrid Organizations: The Case of Commercial Microfinance Organizations. *Academy of Management Journal*, 53 (6), pp.1419–1440.

Berg, M. (1997) *Rationalizing Medical Work: Decision-support Techniques and Medical Practices*. MIT Press.

Berg, M., Aarts, J. & van der Lei, J. (2003) ICT in health care: sociotechnical approaches. *Methods of Information in Medicine*, 42 (4), pp.297–301.

Bjørn, P., Burgoyne, S., Crompton, V., MacDonald, T., Pickering, B. & Munro, S. (2009) Boundary Factors and Contextual Contingencies: Configuring Electronic Templates for Health care Professionals. *European Journal of Information Systems*, 18, pp.428–441.

Bloomfield, B.P. & Hayes, N. (2009) Power and Organizational Transformation through Technology: Hybrids of Electronic Government. *Organization Studies*, 30 (5), pp.461–487.

Boulus, N. & Bjorn, P. (2010) A cross-case analysis of technology-in-use practices: EPR-adaptation in Canada and Norway. *International Journal of Medical Informatics*, 79 (6), pp.e97–e108.

Brigham, M. & Hayes, N. (2013) Hybridity, consulting and e-development in the making: inscribing new practices of impact assessment and value management. *Information Technology for Development*, 19 (2), pp.112–132.

Brunsson, N., Rasche, A. & Seidl, D. (2012) The Dynamics of Standardization: Three Perspectives on Standards in Organization Studies. *Organization Studies*, 33 (5-6), pp.613–632.

Callon, M. (1986) Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay. In: J. Law ed. *Power, Action and Belief*. London, Routledge & Kegan Paul, pp.196–233.

Crotty, M.J. (1998) *The Foundations of Social Research: Meaning and Perspective in the Research Process*. Sage Publications Ltd.

Czarniawska, B. (2008) *A Theory of Organizing*. illustrated edition. Edward Elgar Publishing Ltd.

Czarniawska, B. & Sevon, G. (2005) Translation is a vehicle, imitation its motor and fashion sits at the wheel. In: B. Czarniawska & G. Sevon eds. *Global Ideas: How Ideas, Objects and Practices Travel in the Global Economy*. Copenhagen Business School Press, pp.7–12.

Davidson, E. & Chiasson, M. (2005) Contextual influences on technology use mediation: a comparative analysis of electronic medical record systems. *European Journal of Information Systems*, 14 (1), pp.6–18.

Davidson, E.J. & Chismar, W.G. (2007) The Interaction of Institutionally Triggered and Technology-Triggered Social Structure Change: An Investigation of Computerized Physician Order Entry. *MIS Quarterly*, 31 (4), pp.739–758.

Department of Health (2006) The National Programme for IT in the NHS. Available from:

<http://www.nao.org.uk/publications/0506/department_of_health_the_nati.asp x>.

Ellingsen, G. & Monteiro, E. (2003) A Patchwork Planet Integration and Cooperation in Hospitals. *Comput. Supported Coop. Work*, 12 (1), pp.71–95.

Ellingsen, G. & Monteiro, E. (2008) The organizing vision of integrated health information systems. *Health Informatics Journal*, 14 (3), pp.223–236.

Fuller, S. (2000) Why Science Studies Has Never Been Critical of Science Some Recent Lessons on How to Be a Helpful Nuisance and a Harmless Radical. *Philosophy of the Social Sciences*, 30 (1), pp.5–32.

Greenhalgh, T. et al (2009) Tensions and paradoxes in electronic patient record research: a systematic literature review using the meta-narrative method. *The Milbank Quarterly*, 87 (4), pp.729–788.

Greenhalgh, T., Stramer, K., Bratan, T., Byrne, E., Mohammad, Y. & Russell, J. (2008) Introduction of shared electronic records: multi-site case study using diffusion of innovation theory. *BMJ*, 337 (oct23_1), p.a1786.

Håland, E. (2012) Introducing the electronic patient record (EPR) in a hospital setting: boundary work and shifting constructions of professional identities. *Sociology of Health & Illness*, 34 (5), pp.761–775.

Hanseth, O., Jacucci, E., Grisot, M. & Aanestad, M. (2006) Reflexive Standardization: Side Effects and Complexity in Standard Making. *MIS Quarterly*, 30 (Special Issue), pp.563–581.

Hanseth, O. & Lundberg, N. (2001) Designing Work Oriented Infrastructures. *Computer Supported Cooperative Work*, 10 (3-4), pp.347–372.

Hanseth, O., Monteiro, E. & Hatling, M. (1996) Developing Information Infrastructure: The Tension between Standardisation and Flexibility. *Science, Technology & Human Values*, 21 (4), pp.407–426.

Haraway, D. (1991) A cyborg manifesto: science, technology and socialist-feminism in the late 20th century. In: *Simians, Cyborgs and Women: The Reinvention of Nature*. New York, Routledge, pp.149–181.

Hislop, D. (2002) The client role in consultancy relations during the appropriation of technological innovations. *Research Policy*, 31 (5), pp.657–671.

Jensen, C.B. & Winthereik, B.R. (2002) Political and moralising moments: on visions of IT in Danish health care. *Information Technology & People*, 15 (3), pp.227–241.

Jensen, T. & Kjaergaard, A. (2010) Using Existing Response Repertoires to Make Sense of Information System Implementation. *Scandinavian Journal of Information Systems*, 22 (2). Available from: <http://aisel.aisnet.org/sjis/vol22/iss2/2>.

Jensen, T.B. & Aanestad, M. (2006) How Healthcare Professionals 'Make Sense' of an Electronic Patient Record Adoption. *Information Systems Management*, 24, pp.29–42.

Jones, M. (2003) 'Computers can land people on Mars, why can't they get them to work in a hospital?' Implementation of an Electronic Patient Record System in a UK Hospital. *Methods of Information in Medicine*, 42 (4), pp.410–415.

Kallinikos, J. (2010) *Governing Through Technology: Information Artefacts and Social Practice*. Palgrave Macmillan.

Klecun, E., Lichtner, V., Cornford, T. & Petrakaki, D. (2014) Evaluation as a Multi-Ontological Endeavour: A Case from the English National Program for IT in Healthcare. *Journal of the Association for Information Systems*, 15 (3), pp.147–176.

Lapointe, L. & Rivard, S. (2005) A multilevel model of resistance to information technology implementation. *MIS Q.*, 29 (3), pp.461–491.

Latour, B. (2007) *Reassembling the Social: An Introduction to Actor-Network-Theory*. New Ed. OUP Oxford.

Latour, B. (1987) *Science in Action: How to Follow Scientists and Engineers Through Society*. New edition. Harvard University Press.

Latour, B. (1993) *We Have Never Been Modern*. Cambridge, Mass, Harvard University Press.

Miller, P., Kurunmäki, L. & O'Leary, T. (2008) Accounting, hybrids and the management of risk. *Accounting, Organizations and Society*, 33 (7–8), pp.942–967.

Millerand, F. & Baker, K.S. (2010) Who are the users? Who are the developers? Webs of users and developers in the development process of a technical standard. *Information Systems Journal*, 20 (2), pp.137–161.

Mumford, E. (2011) *Redesigning Human Systems*. Hershey, PA, Information Science Publishing.

Nicholson, B. & Sahay, S. (2004) Embedded knowledge and offshore software development. *Information and Organization*, 14 (4), pp.329–365.

Oborn, E., Barrett, M. & Davidson, E. (2011) Unity in Diversity: Electronic Patient Record Use in Multidisciplinary Practice. *Information Systems Research*, 22 (3), pp.547 –564.

Pieterse, J.N. (2001) Hybridity, So What? The Anti-Hybridity Backlash and the Riddles of Recognition. *Theory, Culture & Society*, 18 (2-3), pp.219–245.

Pollock, N., Williams, R. & Procter, R. (2003) Fitting Standard Software Packages to Non-standard Organizations: The '' Biography' of an Enterprise-wide System. *Technology Analysis & Strategic Management*, 15, pp.317–332.

Ramiller, N.C. (2005) Applying the sociology of translation to a system project in a lagging enterprise. *Journal of Information Technology Theory and Application*, 7 (1), pp.51–76.

Robertson, A. et al (2010) Implementation and adoption of nationwide electronic health records in secondary care in England: qualitative analysis of interim results from a prospective national evaluation. *BMJ*, 341 (sep01 3), pp.c4564–c4564.

Rutherford, J. (1998) The Third Space. Interview with Homi Bhabha. In: *Identity: Community, Culture, Difference*. London, Lawrence & Wishart Ltd, pp.207–221.

Sawyer, S. (2000) Packaged software: implications of the differences from custom approaches to software development. *European Journal of Information Systems*, 9, pp.47–58.

Scott, J.E. & Kaindl, L. (2000) Enhancing functionality in an enterprise software package. *Inf. Manage.*, 37 (3), pp.111–122.

Sheikh, A. et al (2011) Implementation and adoption of nationwide electronic health records in secondary care in England: final qualitative results from prospective national evaluation in 'early adopter' hospitals. *BMJ*, 343, pp.d6054–d6054.

Shimoni, B. & Bergmann, H. (2006) Managing in a Changing World: From Multiculturalism to Hybridization--The Production of Hybrid Management Cultures in Israel, Thailand, and Mexico. *The Academy of Management Perspectives*, 20 (3), pp.76–89.

Singleton, V. & Michael, M. (1993) Actor-Networks and Ambivalence: General Practitioners in the UK Cervical Screening Programme. *Social Studies of Science*, 23 (2), pp.227–264.

Star, S.L. (1991) Power, technology and the phenomenology of conventions: on being allergic to onions. In: *Sociology of Monsters: Essays on Power, Technology and Domination*. Routledge, pp.26–55.

Strathern, M. (1991) *Partial Connections*. USA, Rowman and Littlefield Publishers.

Strauss, A.L. (1987) *Qualitative Analysis for Social Scientists*. Cambridge University Press.

Takian, A., Petrakaki, D., Cornford, T., Sheikh, A. & Barber, N. (2012) Building a house on shifting sand: methodological considerations when evaluating the implementation and adoption of national electronic health record systems. *BMC Health Services Research*, 12 (1), p.105.

Timmermans, S. & Berg, M. (1997) Standardization in Action: Achieving Local Universality through Medical Protocols. *Social Studies of Science*, 27 (2), pp.273–305.

Timmermans, S. & Berg, M. (2003) *The gold standard: The challenges of evidence-based medicine and standardization in health care*. Temple University Press.

Timmermans, S. & Epstein, S. (2010) A World of Standards but not a Standard World: Toward a Sociology of Standards and Standardization. *Annual Review of Sociology*, 36 (1), pp.69–89.

Vikkelsø, S. (2005) Subtle Redistribution of Work, Attention and Risks: Electronic Patient Records and Organisational Consequences. *Scandinavian Journal of Information Systems*, 17 (1).

Wagner, E.L. & Newell, S. (2004) 'Best' for whom?: the tension between 'best practice' ERP packages and diverse epistemic cultures in a university context. *The Journal of Strategic Information Systems*, 13 (4), pp.305–328.

Walsham, G. (2001) *Making a World of Difference: IT in a Global Context*. 1st ed. Wiley.

Williams, R. & Pollock, N. (2008) *Software and Organisations*. Routledge.

Yeow, A. & Sia, S.K. (2008) Negotiating 'best practices' in package software implementation. *Information and Organization*, 18 (1), pp.1–28.