



Problematic Assimilation of ICTs in Radiology Practices: An Exploratory Investigation of the Four Dimensions of the Social Actor Framework

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ABSTRACT

This paper challenges the notion that the ICT assimilation process is an individualistic choice within an organisation, and that adoption alone does not determine further use or success in the ICT implementation process. Secondly, this study suggests that a broader approach in thinking is needed to understand the issues both within and outside the organisation that may impact on the ICT assimilation process. Third, given the limitations of previous research, the need for further development of socio-technical theory from a "human" ICT perspective including micro- and macro-level analysis is needed to extend knowledge in this field. The Four Dimensions of the Social Actor Framework was used to inform this research. This paper presents preliminary findings from an ongoing interpretive study on the problematic implementation of a new enterprise-wide system in Australian radiology practices.

INTRODUCTION

The enablers and constrainers in the process of information and communications technology (ICT) adoption and assimilation is an area of research that provides an array of differing models and frameworks. Models of information technology (IT) adoption and diffusion have been closely examined over a number of decades in Information Systems (IS) research, providing researchers and practitioners with greater insight and understanding of the issues that will ultimately lead to the success or failure during the adoption of an ICT. However, once a decision is made to adopt an ICT, the process of assimilation must then necessarily take place and it is in this area of research that the enablers and constrainers during the ICT assimilation process remain poorly understood (Zhu & Kraemer 2005; Fichman 2000; Delone & McLean 1992; Cooper & Zmud 1990). The goal of this research is to examine the social, cultural, political and institutional environment of the organisation at both the micro- (individual) and macro-level (organisational/external). The research question is therefore to determine the impacts of these constructs and contexts on the success or failure of ICTs during the assimilation process in radiology practices.

The impetus for this study began when an investigation of empirical research demonstrated a number of concerning issues related to the ICT assimilation process. Firstly, the high failure rate of ICTs (findings of 70% in Canadian organisations and 60% in Malaysian organisations) after the initial adoption period is, to a large degree, unexplained (Raheb 1992; Chong 1993). Although both authors acknowledge that human factors in ICT assimilation were the major element that enabled or constrained ICT use, they argue that more research into this phenomenon is needed to provide a better understanding of the contexts that work for or against individuals and/or the organisation during the ICT assimilation process. This study applies the Four Dimensions of the Social Actor Framework developed by Lamb and Kling (2003), which provides a lens with which to investigate this phenomena. Literature

that underpins the conceptual development of this framework and an explanation of the four dimensions of the social actor is presented in the literature review.

LITERATURE REVIEW

Much of the previous research on Diffusion Theory and Models of IT adoption and assimilation, with an emphasis on economic theory and technologically deterministic studies, is limited in terms of extrapolating the findings to the ICT assimilation process (Fisher & Howell 2004; Walsham 1999; Kling & Hert 1998; Eastman 1991; Templer 1989). Most studies in this field focus on the adoption process itself as a 'point in time – one off' occurrence, largely ignoring the assimilation process where ICTs can become particularly problematic at the individual and/or organisational level. In addition, the general focus of diffusion theory and models of IT adoption and assimilation is on individualistic choice (that is, micro-level analysis), which ignores the organisational perspective where ICT adoption and assimilation decisions are determined, and enforced usage is the norm. This research aims to address these limitations by answering the question: what are the micro- and macro-level enablers and constrainers during ICT assimilation on Radiology practices.

Whilst not wishing to understate the importance of the human side of ICT assimilation and use, the focus on micro-level analysis only results in the exclusion of macro-level issues that empirical studies have shown will impact on the environment of the organisation, and therefore, the wider social, cultural and political contexts (Woolgar 1991; Bijker & Law 1992; Orlikowski 2000; Orlikowski & Barley 2001; Carroll et al. 2001). Consequently, although earlier diffusion theory and models of IT adoption and assimilation provide useful constructs for micro-level analysis which is relevant to this study, a more holistic approach is needed which is inclusive of macro-level contexts and constructs.

To address broader social and institutional contexts, it is necessary to turn to socio-technical theory and research, which purports to include macro-level analysis. The various theories (for example, Institutional theory, Social Informatics and Actor Network Theory) suggest that individuals bring to their organisation their own view of the world, their experiences and perceptions, and their cultural and social values and context (Latour 1986; Callon 1997). In addition, socio-technical literature suggests that the organisation develops, over time, its own identity, its particular style of management and its own social and cultural values. Further, the environment in which the organisation operates, the industry it belongs to, the expectations of clients and customers, and the demands of suppliers, government and other affiliations of the organisation have been shown to influence the process of ICT assimilation (Lamb & Kling 2003; Orlikowski & Barley 2001; Orlikowski 2000; McLaughlin et al. 1999; Van Akkeren & Cavaye 1999). Researchers in the fields of Institutional theory, Social Informatics

and Actor Network Theory support the notion that the process of ICT assimilation is dependent on, and influenced by, a number of complex social, institutional and/or cultural constructs (Latour 1986; Callon 1997; Orlikowski 2000; Lamb & Kling 2003; Scott 1987). Therefore, empirical studies from the socio-technical perspective provide useful constructs and contexts that are applicable to this study.

Beginning with Institutional Theory, in its purest definition, it suggests that both technological artefacts and technologically supported organisational transformation are understood to be mere expressions of social relations (Burt & Taylor 2000). However, Institutional Theory has been described as 'socially deterministic', and in this sense, fails to acknowledge either the 'concreteness' of technology, or the potential for such 'concrete' technological artefacts to influence organisational continuity or change (Burt & Taylor 2000). Barrett and Walsham (1999) support this, arguing that in addition to the broader institutional factors impacting on the assimilation process are the ICTs themselves. They also reported that individual level concerns, attitudes and beliefs had impacted on the ICT assimilation process and called for research that is inclusive of both micro- and macro-level analysis. Importantly, Barrett and Walsham (1991) and Lamb and Kling (2003) argue that the ICTs themselves cannot be ignored and should form part of the analysis in empirical studies on ICT assimilation and use. Therefore, although Institutional Theory provides valuable insight and greater understanding of the macro-level issues that have been shown to impact on the ICT assimilation process, this study includes constructs that address both micro- and macro-level issues.

An examination of Social Informatics theory provides a broad range of constructs and contexts at the micro- and macro-level to aid in the understanding of the ICT assimilation process. SI research recognises that ICTs and the social and organisational settings in which they are embedded are in a relationship of mutual shaping (Bijker 1993; Kling 2000; Orlikowski & Baroudi 1991; Sawyer & Rosenbaum 2000), and supports the view that micro- and macro-level analysis of constructs and contexts that impact on the ICT assimilation process need consideration. However, SI theory has two major limitations, firstly, it does not provide a clear framework and consequently, research has resulted in either a very narrow focus or inconsistent findings. Secondly, studies have focused mainly on micro-level analysis, which largely ignores institutional and other macro-level constructs which other research has shown will impact on the ICT assimilation process (Walsham 1999; Orlikowski & Barley 2001; Orlikowski 2000). This study attempts to overcome the limitations identified in SI research in two ways; firstly, a framework will be used that will provide a clear path with which to address the many issues and contexts that earlier research has shown will impact on the ICT assimilation process; and secondly, data design and analysis will be inclusive of both micro- and macro-level constructs and contexts.

Actor Network Theory (ANT) also informs this study as it is posited as an approach to structuring and explaining the links between society and technology and offers explanations of how ICTs become acceptable and consequently, is taken up by groups in society (McBride 2001; Callon & Latour 1981). The relevance to this study is that ANT provides a conceptual framework (the four stages of translation) to examine the social actor and how their actions, beliefs, culture and intentions impacted on the process of ICT assimilation. However, limitations of ANT for this study became apparent when reviewing the literature, namely; it has been criticised for its focus on the local and contingent aspects of socio-technical change, largely ignoring broader social and cultural processes (Allen 2004); and secondly, ANT studies almost exclusively focus on the micro-politics of alliance building, paying little attention to the influence of institutional or cultural routines (Layne 1998).

Although Latour (1996) suggests that ANT is a technique that is meant to bypass and transcend the traditional divide between micro- and macro-level analyses, the literature demonstrates that in practice, the actor network fails to explain events that transcend the individual actors (Parayil 1999). The four dimensions of the social actor framework

(Lamb & Kling 2003) attempts to overcome these limitations and was used as the basis for constructing the contexts and issues surrounding the ICT assimilation process, with some modifications that are required to address the research problem, that is, *during ICT assimilation, what individual, organisational and institutional level constructs enable or constrain the process?* A discussion of how the four dimensions of the social actor framework was used to further explore and understand the research problem will now be presented.

THEORETICAL FRAMEWORK: FOUR DIMENSIONS OF THE SOCIAL ACTOR

The four dimensions of the social actor framework was shaped through re-conceptualising the user by theorising from socio-technical and social-constructionist approaches such as diffusion theory, social constructivism, institutionalist theory and ANT (Lamb & Kling 2003 p.203). They argue that the process of ICT assimilation will be impacted by industry pressures, inter-organisational relationships, and social interactions and posit that a multidimensional view of the entire organisation aids in the examination of both macro and micro-level phenomena of the organisational context of ICT assimilation and use.

Put simply, the four dimensions of the social actor framework include the relationships of networks or *affiliations* of the organisation, and the larger *environmental scope* of the organisation as influencing ICT assimilation and use. In addition, the *interactions* between individuals within the organisation, between groups within the organisation and between groups within and outside the organisation need to be considered, and finally, the *identities* of the firm, individuals, their clients and their competitors will all influence and shape ICT assimilation. Each of the four dimensions will now be briefly explained.

Affiliations

The selection of ICTs can be more strongly influenced by institutional norms than by personal preferences. In addition, Lamb and Kling (2003) suggest that an organisation may need networked ICTs as affiliations want or demand it, and therefore, the dimension of affiliations necessarily influences the adoption and assimilation of innovations. This dimension focuses on macro-level analysis including politics, industry pressures and the culture surrounding the organisation.

Environment

The dimension of *environment* describes the network of relationships that call for the exchange of information and the use of ICTs. Influences within the environment include the stabilised, regulated, or institutionalised practices, associations and locations that circumscribe organisational action (Lamb & Kling 2003). It is argued that firms are more strongly influenced by technological and institutional pressures from their environments, and consequently, these pressures impact on the ICT assimilation process. The focus of the environmental dimension is also at the macro-level.

Interactions

Interactions consist of packages of information, resources, and media of exchange that organisational members mobilise to engage with members of affiliated organisations. They argue that ICT assimilation is influenced by the information needs of the people and organisations they interact with. Examples can include macro-level constructs such as regulative institutionalist concepts (mandates, coercion and sanctions), and micro-level constructs such as the influence of family, education, work setting, and the cultural rules and social routines of the organisation, the organisational members and other individuals. Lamb and Kling (2003) also suggest that ICTs may need to be reshaped to conform to these influences, and supporting ANT, that ICTs are reshaped by interaction practices and events. Additional constructs that have been identified by this researcher include time and distance pressures (physical/temporal), the internal politics of the firm, and the

country in which it operates or has dealings with. This dimension addresses both micro- and macro-level constructs.

Identities

Organisational members are continually constructing identities for their firm, themselves, and for their competitors and clients. Therefore, ICTs are used to construct identities and control perceptions. Organisational members create their identities and ascribe particular qualities and propensities to entities in the firm and to themselves and consequently, this impacts on the ICT assimilation process (Lamb & Kling 2003). This researcher has also identified additional constructs that could be included in this dimension. They are the demographics of the human social actor such as age, experience, and technological know-how.

The framework developed by Lamb and Kling (2003) provides a richer environment in which to gain a deeper understanding of the factors that influence the process of ICT assimilation within complex organisations. The next section of the paper discusses the selection of the method most appropriate for exploratory, interpretive research.

METHODOLOGY

This study seeks to understand and gain greater insight into the ICT assimilation process, and therefore, an interpretive epistemology is warranted. In this epistemology, researchers seek a relativistic understanding of phenomena, assuming that people create and associate their own subjective and inter-subjective meanings as they interact with the world around them (Walsham 2000; Orlikowski & Baroudi 1991). The underlying assumption is that by placing people in their social contexts there is greater opportunity to understand the perceptions they have of their own activities (Hussey and Hussey 1997). Therefore, the interpretivist paradigm is concerned with the uniqueness of a particular situation, contributing to the underlying pursuit of contextual depth (Myers 1997).

Due to the lack of prior empirical research on the topic, a theory refinement research design was chosen. Using the logical sequence of phases from theory exploration to theory refinement to theory testing, this research is situated in the middle ground, and seeks to illustrate the framework's capacity to illuminate a phenomenon in new or better ways. Qualitative approaches based on in-depth case studies in a number of radiology practices under the umbrella of one organisation were chosen.

The Case. The study focuses on Australian radiology practices. The radiology sector of the medical profession was chosen due to the extremely important role that ICTs play in the success of practices in this industry. In addition, the organisation selected had recently implemented and assimilated an in-house developed software program. The paper uses the pseudonym The Practice for the purpose of maintaining anonymity and confidentiality to the case study participants. The unit of analysis for the preliminary case study presented in this paper was a radiologist and senior executive. In addition, observations at three radiology practices were undertaken.

Data Collection & Analysis This research used the following procedures: a schedule of site visits using a variety of data collection techniques such as purposeful sampling, in-depth semi-structured face-to-face interviews as the primary data source with observations and documents being minor sources of data; a pilot study; within case analysis using techniques such as a content summary form, displaying data in summary tables; the identification of critical incidents; and lastly the combining of the qualitative responses into narratives or decision 'stories'. Considering this research's interpretive stance, the ultimate goal is to describe the context in which events occur (Kelliher 2005); to make sense of the whole situation and the relationship between people, the organisation and the technology (Myers & Avison 2002). To preserve the richness of the data, and to remain aligned with the interpretive paradigm, the researcher did not convert the data into numbers, but instead presents a holistic view of the content and contexts. At the time of writing this

paper, data from the first round of interviews and observations from three practices were used.

FINDINGS

The four dimensions of *affiliations*, *environment*, *interactions* and *identities* cannot be isolated from one another. Lamb and Kling (2003) argue that each of the dimensions, to a greater or lesser degree depending on the organisation, is related to or influenced by the other dimensions. The company had recently implemented a new program that all employees in each of the practices were expected to assimilate into their daily tasks and processes, including radiologists, radiographers and administrative personnel. Illustrations of the relationships between the four dimensions of The Practice, the ICT and the individuals within the practice based on the preliminary interviews, are now presented.

Relationships between the Four Dimensions – Preliminary Findings

The relationships between the *affiliations* of the practice are numerous and include hospitals; general practitioners; radiology hardware/software distributors (CT and ultrasound equipment); national and international radiology [industry] bodies; maintenance and parts suppliers; IT specialists; shareholders and so on. The *environment* in which the practices operate varies depending on whether it is based in a hospital or whether it is a 'stand-alone' practice. Regardless, the medical industry is highly regulated with strict guidelines, reporting procedures and quality control measures that must be adhered to. These regulations come from *affiliations* such as radiology industry bodies or government agencies, and in addition, if the practice is hospital based, from the rules, procedures, cultural and social context of the hospital itself. Therefore, a radiology practice can be described as being highly institutionalised and strongly technologically based.

Executive "There are rules and regulations that [The Practice] must adhere to, and the software had to necessarily incorporate procedures and processes to meet those requirements".

Consequently, the program is complex as dictated by the affiliations of the organisation and the environment in which it operates, and many 'screens' need to be completed by radiologists, administrators and radiographers to ensure adherence to these regulations and mandates.

The competitive nature of the industry, which demands fast turn-around times for patients and high quality service (a patient's life can depend on the accuracy of the film and consequent diagnosis), also influences the *environment* of the practice. Therefore, the nature and type of affiliations, and their expectations influence the environment of a radiology practice. For example, there are expectations from affiliates, such as a hospital, that a practice have a high level of infrastructural richness to meet its administrative and patient/client needs. However, the fast turn-around time and having to incorporate the new program clashed with individual perceptions of quality care (*identity*) by one radiologist who states:

"We are under a great deal of pressure to conform and adjust to the new program whilst trying to maintain quality standards of patient diagnosis under great time pressures".

This radiologist was frustrated by the amount of time needed to complete the requirements built into the program and the slowness of the new system, and felt that it was impacting on his professional reputation. Therefore, the *environment* within and outside the organisation had impacted on the *identity* of the radiologist. In this particular case, the assimilation of the program had been problematic with some resistance, particularly from the radiologists who felt the pressure of incorporating the program into their daily routine detracted from their professional

duties. In fact, the pressure for some of the radiologists was so high that their frustration manifested into with two doctors literally kicking holes in the wall. The executive stated:

"[They] kicked walls, putting holes in the walls. There was the expense of sending out a tradesman to fill the holes in the wall. There have been two of those. Um cursing, swearing, there's probably frustration and anger, we haven't had any examples of where it has affected reporting, I think, but I am sure that it probably could potentially, but basically grumpiness of the radiologists was a big issue".

When asked as a follow-up question whether radiographers or administrative staff were equally frustrated and reacted in a similar fashion, the executive stated:

"No, they [administrative staff] just cried". [Executive laughs]

The types of *affiliations* The Practice has to deal with, and the *environment*, which sets mandates, procedures, and regulations that need to be adhered to, influenced the *interactions* of the practice. In addition, the information needs, resources and media of exchange of the practice's *affiliations* shaped the way in which the practice adopted and assimilated the ICT. For example, the radiologist posited that the use of tele-radiology¹ was increasing and the technological infrastructure needed to run the tele-radiology is therefore determined by the *environment* (including the technological and institutional pressures), and from the *affiliates* who request the service. However, this has impacted on the radiologists' ability to assimilate the new ICT:

Radiologist "....also, with tele-radiology films constantly arriving as well as the walk-in clients, we [doctors] are placed under increasing pressure to adopt and adapt to the program whilst trying to complete our diagnosis. There was very little training on the program, and it was very slow. Consequently, it affects your professionalism."

This radiologist was particularly annoyed at the pressure of having to learn the new program whilst trying to maintain standards, as well as the technical problem of the system been very slow or crashing and felt that his professional reputation was been compromised. As previously mentioned, radiology and imaging practices are a highly competitive industry in Australia, where key radiology organisations compete for consultations from referring doctors (clients). A practice will therefore wish to convey an image as being 'cutting-edge' in terms of the services they offer and the quality of their diagnosis (*interactions/identities*). The use of latest ICTs does, to some degree, differentiate one radiology practice from another. Therefore, the social actors in this case wish to convey a highly professional, timely, and technologically sound identity to its clients. Consequently, the need to assimilate ICTs and other innovations that have been introduced into the Practices are, in part, influenced by the identity an individual wishes to convey. In reality however, for many of the individuals, the wish to improve efficiency and client perceptions of the organisation had failed.

Executive: "On a continuum where at one end you have "success" and the other "failure", and then varying levels of both along the scale, the variation is enormous. Some practices have been spectacularly successful in using the program, others an abject failure, and the rest somewhere in between those two extremes".

The frustration felt at management level is replicated in the practices visited to date. Ongoing research is continuing to determine further contexts from the four dimensions that have shown the greatest impact on the success or failure of the ICT assimilation process.

CONCLUSION

This paper describes a framework used as a lens to gain greater insight into the contexts and constructs that impact on the ICT assimilation process in Australian radiology practices. Preliminary interviews indicate that the four dimensions of the social actor framework is useful for helping to explain the complex interrelationships between institutional, environmental and individual level constructs that impacted on ICT assimilation for The Practice. Analysis of the findings from the preliminary interviews and observations indicates a strong link between the affiliations of the practice and the environment in which it operates. Also, the institutionalised and highly technical environment, coupled with the high pressures of a busy practice has shown to impact on the identities of the various employees within the practice.

Observations by the researcher during the preliminary interviews also demonstrated a culture within the practice that clearly delineated the radiologists (doctors), radiographers (technicians) and administrative staff. Further investigation of the culture of various practices and the social networks within each practice will form part of ongoing data collection. The study thus far is an exploratory investigation and further in-depth interviews and observations need to be collected from a number of different practices to gain a deeper understanding of the applicability of the framework. In addition, the researcher is currently collecting further data to gain a deeper insight into the micro- and macro-level constructs that had the greatest impact on the ICT assimilation process.

Finally, there are many potential avenues for future research. For example, research into other industry groups, including cross-case analysis, could provide a deeper understanding of the impacts on the ICT assimilation process. In addition, as the culture of the organisation and the environment within which it operates appears to have impacted on the assimilation process, further research that includes different and/or similar cultures (for example, other states or countries) could provide rich insights into the enablers and/or constraints on the ICT assimilation process.

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ENDNOTES

- 1 Tele-radiology is the transmission of films from a practice (that does not have a radiologist present), directly to the information systems of another practice for diagnosis by the radiologist on duty.

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