2007

# A Social Informatics Account of the Assimilation of an Enterprise-Wide Health Information System

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## Abstract

*This paper presents findings from a case study of the assimilation process of an enterprise-wide information system in radiology practices in Australia. Interviews with radiologists, radiographers and administrative staff are used to explore the impact of institutional structures on the assimilation process. The paper develops an argument that culture within and outside the practice, institutional structures within the practice and organizational-level management mandates impacted on the assimilation process. The study explores a theoretical framework that integrates elements of social actor theory (Lamb & Kling, 2003) providing a more fine-grained analysis concentrating on the relationships among the radiology practitioners, the technology (an enterprise-wide HIS), and a larger social milieu surrounding its use. Findings are reported that demonstrate both the enablers and inhibitors to the assimilation process based on in-depth interviews with radiology practitioners.*

### Keywords

HIS assimilation, health informatics practice, social actor model.

## Introduction

Health Informatics is a relatively under-researched area, and one in need of in-depth analysis and reporting given that the assimilation of health information systems (HIS) has been largely unsuccessful (Heeks 2006). This paper addresses this lack of research by studying the HIS assimilation process in a large Australian radiology practice. In this paper HISs are defined as encompassing all those technologies that enable the handling of information and facilitate different forms of communication among human actors, between human actors and electronic systems, and among electronic systems. According to Klecun & Cronford (2005) many contemporary health information systems are complex and aim to be both technologically and organisationally innovative, involving a large number of different stakeholders, spanning institutions and professions with the potential of changing both the way people and organisations work and the ways in which services are delivered and experienced. This research supports that view with the aim of identifying the issues that have enabled and/or hindered the process. This paper reports on research into how radiology practitioners assimilate a health information system with a focus on describing how assimilation is bound up in everyday social and organisational structures.

Previous research has tended to focus on the features of the HIS and individual's behaviour while under-emphasising the role of context and institutional structures for example, Davis (1989), Ajzen (1991), and Taylor & Todd (1995). Among the many studies of HIS assimilation in the health literature, few pay attention to the role of context, social and organisational structures embedded in the HIS. Technocentric views of the systems assimilation processes omit the role of human agents and the existing organisational and social contexts in the assimilation of HIS artifacts. Walsham (1993) argues that political, cultural and organisational aspects must be seen as necessarily playing a major role in shaping the evolution activity of the assimilation process. This research supports Walsham's view that it is the roles of the human actors, the interplay between the organisation, the HIS, the social and political contexts and the broader institutional factors that will ultimately impact on the HIS assimilation process. Previous research in HIS has not had this focus and we argue, therefore, that an institutional focus is a preferred lens to study assimilation as it takes a more holistic approach by looking at the organization, and the environment surrounding the organization. King et al (1994) defines an institution to be considered as any standing, social entity that exerts influence and regulation over other social entities as a persistent feature of social life, outlasting the social entities it influences and regulates, and surviving upheaval in the social order. The case

study reported in this paper develops the argument that institutional forces embedded within health information systems are active forces in the systems assimilation process. For instance, the influence of the radiography systems occurs both through the material constraints such as Intranet technology, prescriptions of process such as patient validation mandated by the system, and through the experiences and learning from previous use of the system that shapes workers' approaches to using the HIS in their workplace. This case study also contributes to our understanding of HIS assimilation by exploring the role of institutional structures such as government requirements and industry pressures in the assimilation of health HISs by radiology practitioners.

This research is important for the following three reasons. Firstly, it takes a more holistic approach by incorporating institutional, social and individual level analyses to gain a greater understanding of the reasons behind the often high failure rate of HIS assimilation. Second, previous research has tended to focus on technical issues, largely ignoring other factors that researchers have shown will impact on the attitudes and acceptance of a new IS. The third reason is that the broader HIS literature is dominated by individualistic theories of human behaviour, for example, the Technology Acceptance Model, Theory of Reasoned Action, Diffusion of Innovation, etc. In contrast, this case adopted an analytical perspective (Kling, Rosenbaum & Sawyer 2005) in that the intent was to contribute towards developing socio-organisational theory about HISs in institutional and cultural contexts. The approach to theory building, with an emphasis on concept development and operationalisation made use of Lamb & Kling's (2003) social actor model to illuminate an under-researched aspect of health information systems practice – the context of HIS assimilation within a large Australian radiology practice. By doing so, we have provided an extension of theory of HIS assimilation across four levels: individual, organizational, industry, and societal. This novel theoretical approach, when combined with in-depth empirical research, extends our current understanding of contemporary ICT assimilation. The paper also operationalises the social actor model as first demonstrated in Rowlands (2006) in terms of mapping of the case interview text to the model's sixteen constructs. These are important findings as the social actor model is relatively new.

This paper addresses two research questions: *(1) What are the enablers and inhibitors in the assimilation of a new HIS in radiology practices;* and *(2) Do the dimensions of the social actor model (Lamb & Kling, 2003) illuminate the micro- and macro-level constructs and contexts that impact of the assimilation process in the health industry?* Insight with respect to these questions will be derived from an interpretive case study of the assimilation of an HIS in a large-sized company that encompasses numerous city-based and rural-based radiology practices.

## Theoretical Framework

This case applies Lamb & Kling's (2003) *user as social actor* model as a conceptual lens to understand HIS assimilation within a single organisational setting. The primary strength of this model is that it is context-centred, and conflates people's interactions, their information environments, and their technologies as the basic unit of research analysis. Lamb & Kling's, (2003:213) model describes four dimensions that connect actors to networks and environments and position their assimilation of HISs as integral to their organisational interactions. What follows is an application of the four dimensions to the specific characteristics of the case:

- **Affiliations** represent inter and intra-organisational relationships created and supported by organisational members as a result of their day-to-day activities as part of the organisation. The organisational member may establish these affiliations while acting as part of their organisational roles or in the form of a professional relationship with external entities supported by the organisation. These networks exist within each Practice but also apply to the IT and other health-related industries as well, and to a wider national and international context.

- **Environments**. The environment an organisation operates in is formed by the kind of affiliations it has formed with industry, government institutions and its clients (GPs and patients). HIS assimilation needs to recognise the regulated and/or institutionalised practices of each Practice, and other associations that circumscribe organisational action such as Federal Government Medicare requirements.

- **Interactions**. Social actors see themselves as organisational members working with others (patients, General Practitioners (GPs) and hospital partners exchanging information) enacting a HIS (and other media such as email, telephone, web sites) in support of their interactions. Information and resources are mobilised as people engage with *affiliated* organisations and also depend upon the environment.

- **Identities**. Organisational members regularly enact HISs to compile and present information to various affiliates. In so doing, they create an identity for their organisation and for themselves. This identity is a form of representing the organisation as a single collective identity or projecting an image on behalf of a client based on the information collected. Radiology workers in general are therefore defined by their avowed presentations of the self and ascribed profiles of organisation members as individuals (radiographer, radiologist, administrative worker) or a collective entity (professional medical boards such as the Australian and New Zealand College of Radiologists).

Each of the four dimensions of the social actor model is further comprised of four characteristics or behaviours. These sixteen behaviours were used to develop the initial coding scheme (*c.f.* Tables 1, 2, 3 & 4) for the qualitative analysis of data. However, the social actor model was used solely as a guide. It helped make sense of what occurred in the field, provided a set of sensitizing constructs to be investigated, and guided the interpretation and focus. The following section outlines the methodological approach for this research.

## Research Methods and Approach

An interpretive case study (Walsham 1993), relying primarily on interview data, was used to seek an in-depth understanding of a dynamic, complex, and multi-faceted phenomenon — the assimilation of a new enterprise-wide radiology system—with a large Australian radiography practice. The health services sector was chosen because of the extremely important role that HIS plays in the operation and success of businesses in this industry, and the Practice selected has extensive experience and use in practice of an enterprise-wide health information system. Importantly, the radiology industry is highly technical, highly competitive, as well as being regulated and institutionalised. The selection of the case site was based on a combination of accessibility to the company's owner(s) and branch outlets, and interestingness – in the sense that the chosen Practice is one of Queensland's top three radiology Practices, and its HIS organisation is considered to be a leading player in providing state-of-the-art HIS solutions to patients.

The unit of analysis for the case was a large Australian radiology company with three (3) sites (practices) visited. The practices visited comprised of one city-based and two regional-based practices. Participants included radiologists, radiographers, administrative workers and management with three radiology practitioners interviewed in each practice. For example, in Practice A, a regional-, hospital-based practice, one radiologist, one radiographer and one senior manager were interviewed. Practice B is a city-based stand-alone site and Practice C, a regional-based stand-alone site. In total, nine (9) interviews were completed including three (3) radiologists, two (2) radiographers, three (3) administrative staff and one (1) senior administrator. All *semi-structured interviews* were guided by an interview protocol with slight changes made to each occupational group as needed. The interviews were designed to explore and identify a range of issues including conditions, meanings, compatibility and events.

The multi-dimensional concept of the social actor guided our qualitative data analysis. To commence analysis, the researchers created and operationalised a list of codes prior to fieldwork based on the Lamb and Kling (2003) framework. By operationalisation, we mean that the social actor model was expressed in coded elements that could be identified in textual analysis. Once data were collected, each of the dimensions was listed in Nvivo7 and coded accordingly. Initially, sixteen codes based on the behaviours of connected and situated individuals were drawn from the Lamb and Kling (2003) social actor model, but these were extended as new contexts and/or constructs arose from the data.

## Case Analysis

Each of the four dimensions is presented summary in a table followed by discussion of the major contexts and constructs raised in each dimension. Space restrictions have reduced the number of relevant quotes that support the analysis. Table 1 provides a visual summary of the analysis from the three cases for the dimension 'Interactions'.

**Interactions**

Table 1: Enables and inhibitors of HIS assimilation -Interactions

| Social Actor Dimensions and Code | Characteristics & Behaviours of Connected and Situated Individuals (Lamb & Kling, 2003:213) | Examples from the Case | Enablers | Inhibitors |
|---|---|---|---|---|
| **Interactions [IN]** | | | | |
| [INT-COMM] | Organisational members seek to communicate in legitimate ways | The HIS can be seen as a legitimate and formal communication tool. | ☑☑ | ☑☑ |
| [INT-PROCESS] | Organisational members build, design and develop interactions that make information actionable | The HIS mandates the generation of certain processes requiring a sign-off at each stage (called 'validation'). This is the work culture imposed by senior management. | ☑☑ | ☑☑☑ |
| [INT-CONNECT] | HISs become part of the interaction process as people transform, tailor and embed available informational resources into connections and interactions. | The radiology worker attempts to adjust the HIS in pragmatic and ingenious ways as part of the patient/radiology process to better meet their needs and roles. | ☑ | ☑☑ |
| [INT-SOCIAL] | As organisational members, people perform socially embedded, highly specialised actions on behalf of the organisation | Using the HIS dictates and constrains their role within the Practice – it tells radiology workers what they must do – it's the Practice's way. | ☑ | ☑☑ |

The interaction dimension describes radiology workers in their day-to-day work role networking and relating themselves to others and to the HIS they use to interact with and present themselves to others (their identities). Interactions were prominent issues raised throughout the assimilation process and provided insight into many enabling, but also inhibiting issues that impacted on that process. The parent organisation at senior management level sees the HIS as a vehicle to bring together radiology workers and coordinate their tasks when interacting with each other, clients, industry bodies and government agencies [INT-COMM]. In the view of the senior administrator (Practice A), the HIS helps enable this process:

*"If a good referrer suddenly drops off, it [the HIS] rings an alarm bell, so off he [radiographer] goes and visits the GP and takes a little mud cake or something and has a chat and oh, you know 'I notice you haven't been referring, what's been the problem . Here's a mud cake'. You know, it's not a bribe, it's morning tea". (Chuckles) (A:SnrAd 450-451)*

Also particularly pertinent across the three practices was the non-validation of patients (a crucial part of the patient visit process) due to a lack of understanding of the new process [INT-PROCESS], technological issues with the system [INT-CONNECT], and the negative impacts of an often unreliable system within the practice [INT-SOCIAL]. All participants recognised the value of the system in providing a more streamlined approach to patient care and reporting [INT-PROCESS]. However, a great deal of negativity was prominent in the views of all participants in relation to the loss of identity (appearing incompetent) and a lessening of quality of interactions due to inherent management, cultural and technological issues that were not dealt with by management and/or the parent organisation during the assimilation process and, in many areas, to the present day.

*"Again, it comes down to there not being enough cross-pollination between the technical people and the office staff – they [technical people] don't fully understand the impact if they don't complete the validation". (A:SnrAd 198-199)*

*"[The radiologists] 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. The administrative staff just cried [with frustration at using the new system]". (A:Rdl 178 – 181)*

*"When it crashes and it's slow, that does frustrate you and takes away from those positive things. It's a lot better than it was. I think people forget about how terrible it was when we first got it" (B:Rdl 76-77).*

*"If it's [the IT problem] going to be a long time, you quite often have to say to patients 'Look, we're having some computer problems – would you like to take a seat or do you want to come back? It's awful for us'. (B:Adm 562-563)*

The assimilation process also highlighted an organisational level cultural issue where occupational groups within a practice were treated differently in terms of training on the system and on their requests for change to the system [INT-SOCIAL]. As one participant stated,

*"They [the parent organisation] just don't care" (C:Rdg 113).*

*"They [IT people] can be very abrupt and abrasive with us. They speak very badly of the clerical staff and they are not like that with doctors". (B:Adm 389-390).*

Interactions were prominent issues raised throughout the assimilation process and provided insight into the more negative issues that impacted on that process. All participants, with the exception of one radiographer (Practice C), recognised the value of the system in providing a more streamlined approach to patient care and reporting. However, a great deal of negativity was prominent in the views of all participants in relation to the frustration of an unreliable system and a lessening of quality of interactions due to inherent management, cultural and technological issues that were not dealt with by management.

### Identities

Table 2: Enablers and inhibitors of HIS assimilation - Identities

| Social Actor Dimensions and Code | Characteristics & Behaviours of Connected and Situated Individuals (Lamb & Kling, 2003:213) | Examples from the Case | Enablers | Inhibitors |
|---|---|---|---|---|
| **Identities [ID]** | | | | |
| [IDN-USER] | Social actor identities have an HIS use component | The assimilation of the HIS defines (some of) their identity as a radiology worker. | ☑ | ☑☑ |
| [IDN-DEFINE] | HIS-enhanced networks heighten multiple identities as expert or novice | Knowledge and competent assimilation of the HIS can define the radiology worker's identity as novice or expert. | ☑ | ☑☑☑ |
| [IDN-ROLES] | HIS-enhanced connections among organisation members transcend roles | The HIS can be used differently according to roles they occupy within the practice, both traditional and evolving. | ☑☑ | ☑☑☑ |
| [IDN-PERCEP] | Social actors use HISs to construct identities, legitimise their role, and control perceptions | Assimilation of the HIS legitimises their role as a radiology worker in the eyes of their peers, clients or senior management. | ☑☑ | ☑☑☑ |
| [IDN-DEMO]* | Age, gender and geographic placement will impact on ICT acceptance and use. | The age and gender of the social actor and the geographic position of the practice unit will impact on system use. | ☑ | ☑☑☑ |

According to the transcripts, a key aspect of identities when assimilating the HIS were the negative self-perceptions from participants use of the technology in terms of competency and their changing job roles [IDN-PERCEP] [IDN-ROLES]. This was exacerbated by the technological unreliability of the new system and the lack of education and training [IDN-USER] [IDN-DEFINE].

*"They [the radiologists] felt that they were suddenly becoming typists because they had to make their own corrections". (B:Adm 517-518)*

*"It initially caused a lot of grief with people because of not understanding the program.....and you know, rather than adapting to the program a lot of people attempted to adapt the program to them". (A:SnrAd 91-92)*

All interviewees across the three practices believed that the level of frustration felt by individuals during the assimilation process appeared to be dependant on the level of IT experience of the participants, their age, their social interactions, attitudes and culture [IDN-PERCEP] [IDN-DEMO][1]. In other words, demographic contexts, and social and cultural constructs were reported as impacting on the identities of individuals, and ultimately, the practice overall.

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[1] IDN-DEMO is a new construct that emerged from the interviews not clearly addressed in the original four dimensions framework.

*"Again, I'm not trying to be ageist, but people are set in their ways, they're comfortable with what they do. New technology causes them grief.....really; the best ones are my young radiographers or my 16 – 17 year old junior office girls". (A:SnrAd 412-413)*

*"...One of our senior staff came to work the next morning and resigned, before she'd even used the program...she just said 'I'm never going to get my head around this'". (B:Adm 300-311)*

Another source of frustration was the perception by participants that they were provided with insufficient preparation and training and that ultimately, this inhibited their ability to assimilate the HIS [IDN-USER].

*"They [the trainers] gave you the basics and it's not until you start using [the program] that you know that it can do a lot more than what we were taught". (C:Adm 20-21)*

*"The office staff were shown everything they needed to know but they weren't shown anything about the radiologists or radiographers stuff. The radiographers were shown what they [the parent organisation] believed they had to know but nothing was explained about the office or the doctors. The doctors were shown what they had to know, and of course, they weren't shown anything for anyone else. So basically, no-one had the big picture of what the program is trying to do". (A:SnrAdm 75-78)*

On a more positive note, the ability to access information and the networking between practices throughout the state was perceived as a great improvement for participants. When the program was reliable, all participants felt that there were substantial improvements in their ability to complete their various tasks efficiently [IDN-USER] [IDN-PERCEP]. In summary, the identities dimension of the framework provided a useful lens in which to determine individual [micro-] level social, cultural and attitudinal issues that impacted on the participants' ability to successfully assimilate the HIS.

**Environment**

Table 3: Enablers and inhibitors of HIS assimilation - Environment

| Social Actor Dimensions and Code | Characteristics & Behaviours of Connected and Situated Individuals (Lamb & Kling, 2003:213) | Examples from the Case | Enablers | Inhibitors |
|---|---|---|---|---|
| **Environments [E]** | | | | |
| [ENV-MAND] | Organisational environments exert technical and institutional practices (standards) on the company and their members. | HIS assimilation is supposedly mandatory. It's part of the work culture. All practice work must adhere to it, and the HIS co-ordinates activities and regulates outcomes. | ☑☑ | ☑ |
| [ENV-POLICY] | Environmental dynamics require a display of overall competence. | Placing the HIS on the Intranet creates an online presence displaying the patient status and associated documentation. This is management policy. | ☑ | ☑☑ |
| [ENV-CAPITAL] | HISs are part of the organisational environment and require a substantial investment. | The Practice has a significant HIS investment in personnel, development tools, techniques, and in-house training. | ☑ | ☑☑☑ |
| [ENV-INFRA] | HISs are part of the industry, national, and/or global environment and many software vendors invoke infrastructure richness that promotes use. | Many radiology workers recognised the fact that other proprietary HISs were fully online, & acted as a knowledge repository of patient and practice information, thereby promoting a positive use of an HIS. | ☑ | ☑☑☑ |

Table 3 illustrates the factors that had the greatest impact on the HIS assimilation process. The macro-level, institutional contexts that evolved as the most prominent were the mandated changes stemming from the parent organization [ENV-POLICY], economic constructs such as the lack of skilled radiology workers [ENV-MAND] and finally, technological pressures and developments [ENV-INFRA, ENV-CAPTIAL].

*"I ran an ad for three months for a medical typist and I got two applications. One was 62 and the other couldn't get emails or touch type" (A:Adm 86-87)*

The code [ENV-MAND] was by far the most commonly stated construct in Table 3, indicating that all interviewees understood that the HIS was mandatory, provided a standard for the collection and representation of data and in the ways it can be communicated. Many viewed the HIS as a coordinating, controlling and business

(patient) process mechanism by the controlling body – senior executives of the company. Implementing the HIS was mandatory, and its assimilation was part of work culture. All business processes within each of the practices had to adhere to the new system, and the HIS co-ordinates activities, regulates outcomes, and imposes standards [ENV-MAND] in each practice, and for each individual. According to the social actor model the environment and adherence to industry-wide work practices exert technical and institutional (standards) on The Practice and played a significant guiding role in having the program developed in the first place.

> *"[The program was introduced] for streamlining [the business processes]. Once this program came in, theoretically you could enter a patient's name and get their details.....if they'd been to any of our clinics, anywhere … you could get reports from any clinic, whereas before there was a lot of faxing of reports from one clinic to another...so, that was basically the idea of it.....oh, and checking up on us of course, they can now trace who's doing what and where and when". (C:Rdg 111-115)*

However, practices have been experiencing technical problems and consequently, participants perceive that the program had not been properly set up to meet external clients' demands, in particular, Medicare Australia mandates and rules [ENV-POLICY]:

> *"We have to know the government rules and regulations and know that you can't bill this or that. A lot of times, people are still billing things together but Medicate won't pay." (B:Rdg 96-97).*

The practice also wishes to convey a professional and "slick" image to referring GPs and patients [ENV-POLICY], and part of the reason for developing the program was to improve that image and remain competitive for referrals and to patients. In this sense, the implementation of the HIS has met the needs of the practices in that regard.

> *"Turnaround time is quicker because of the workflow and we can priortise things much better. We can now code patients and prioritise them, so a priority '9' patient goes to the top of the doctor's list. The doctor can see how many waiting patients there are; the radiographer can see how many waiting there are. They can all prioritise their work". (B:Adm 200-204)*

However, some felt that further capital investment [ENV-CAPITAL] was required to improve the system so that it more readily met external needs, particularly in relation to the parent company providing the necessary technological infrastructure needed to run the program effectively [ENV-INFRA].

> *"They [the parent company] say, 'Well the answer is a change request', but we have to pay for it and if they're busy, it will take a long time. It's never being fixed". (B:Adm 119-121)*

In summary, all constructs that relate to the environment dimension of the four dimensions framework have played a part in both enabling and inhibiting the HIS assimilation process. In particular, mandates from the parent company to assimilate the HIS [ENV-MAND] emerged as the strongest enabler in the assimilation process. The other three constructs of [ENV-CAPTIAL], [ENV-POLICY] and [ENV-INFRA] were deemed as inhibitors due to the perceived lack of capital investment, training and technological infrastructure supplied by the parent organization, not only at the beginning of the assimilation process, but to the present day.

**Affiliations**

Table 4: Enablers and inhibitors of HIS assimilation – Affiliations

| Social Actor Dimensions and Code | Characteristics & Behaviours of Connected and Situated Individuals (Lamb & Kling, 2003:213) | Examples from the Case | Enabler | Inhibitor |
|---|---|---|---|---|
| **Affiliations [A]** | | | | |
| [AFF-NETWORKS] | Social actor relationships are shaped by networks of organisational affiliations | Radiology workers benefit more from online data accessibility. | ☑☑ | ☑ |
| [AFF-EXCH] | Relationships are dynamic, and related informational exchanges change with flows of capital, labour, & other resources | Relationships with external affiliates (eg GPs, Patients, Government agencies) improve with better access to information and more efficient information sharing within and outside the practices. | ☑☑ | ☑☑☑ |
| [AFF-MULTI] | Relationships are multilevel, multivalent, multi-network ie. local/global group, organisation, inter-group, inter-organisational culture. | Radiology workers are required to deal with business clients from various sections (social networks) within the Practice to complete the patient process; however power is vested with the business clients and the senior executives of the company. | ☑ | ☑☑ |
| [AFF-RELAT] | As relationships change, interaction practices migrate within & across organisations | New alliances occur between groups within the practices as they work together to assimilate the HIS. Alliances and relationships change with external bodies as the HIS helps the practice to comply with their needs (whether mandated or suggested). These interactions bring about change. | ☑ | ☑☑☑ |

The affiliations for all practices are the Australian Federal Government (Medicare Australia), GPs, patients, the parent organisation, sales representatives for imaging equipment and medical supplies and tele-radiology clients (other practices from the same parent organisation). These interactions bring about change [AFF-RELAT] as external affiliates require information from them. Consequently, as external clients' demands evolve, each practice is expected to meet those needs. Since the assimilation of the new HIS, meeting external client needs has been problematic. For example, during the assimilation process, the new HIS was extremely slow. In addition, due to a perceived lack of training, nearly all radiology workers were experiencing difficulties using the program and completing daily tasks.

*"The radiographers, radiologists and the sonographers – I'm still having trouble trying to get them to fully understand. The training wasn't sufficient for the technical people. The least amount of training that I felt was efficient was for the radiologists, the actual doctors". (A: SnrAdm. 20-21)*

*"[Lack of training] was one of the biggest limitations. They only showed the radiographers how they could do their side of the job, nothing like looking up previous reports, nothing like that. People have had to learn off their own back how to do things". (C:Rdg. 17-19)*

Overall, the lack of training seriously slowed down the work processes in each practice for some months, and the exchange of information with external affiliates [AFF-EXCH], particularly GPs and patients, became inefficient. Also, throughout the assimilation process to the present day, the system, without warning, freezes. Occurrences of the system freezing are generally two to five times per week (depending on the practice) which has had a negative impact on the ability of radiology workers to access and share data with external affiliates such as patients, GPs and Government agencies (Medicare). Consequently, alliances with external affiliates were negatively impacted as each practice struggled to comply with their needs during the assimilation process [AFF-RELAT] [AFF-EXCH].

*"Yeah, it would crash 3 – 4 times a day. We had to reboot the computers and everything would stop and freeze and we couldn't report stuff. Everything came to a great big grinding halt". (A:Rdl 54-56)*

*"It was implemented without being fully tested or completed and it had a lot of bugs and problems, but they put it in anyway". (B:Rdl 10-12)*

Another example of a problematic exchange of information since the new program was assimilated relates to the exchange of information between the practice, government agencies, and ultimately patients [AFF-EXCH] [AFF-RELAT]. There are times when a patient requires more than one procedure on the one day (say, a CT and MRI), however, the government action does not allow both items to be claimed on the same day. The previous HIS would flag a double entry as an "illegal entry" and reject it. The new HIS does not alert the radiology worker to this and allows both entries for the one patient to go through. Consequently, when the account is received by Medicare, it is rejected. As the senior administrator explained:

*"As I see it, it's [the new HIS] actually more of a pain in the bum, because it won't highlight when you put illegal entries in, so it's certainly not helping us comply with Medicare regulations". (A:SnrAd: 26-28)*

This is frustrating for the practice as it results in a delay in payment for the procedures. For the patient who pays for the procedures on the day, it is also problematic as they are rejected when they attempt to claim their money through Medicare Australia:

*"The patient pays in good faith thinking they're going to get their money. They go to Medicare and they say 'no, you're not getting anything', so then the patient comes back here. We've got to rework out what's gone on, and often [have to] write something [one of the procedures] off". (B:Adm: 30-33)*

Relationships between the patient and the practice are negatively impacted and in addition, the practice suffers a financial loss [AFF-EXCH] [AFF-RELAT]. Attempts to have this fault remedied since the assimilation process began have been ignored by both the parent organisation and the developers of the program [AFF-MULTI]. Because of this, radiology workers in this practice felt powerless and frustrated as they attempted to meet their clients' needs. One senior administrator felt that the attitudes and culture at the parent level of the organisation was such that because this case is a regional practice and therefore less profitable than city-based practices, their requests for assistance or change to the program are difficult to manage or ignored [AFF-MULTI]. However, the city-based practice also flagged this as a major issue since the assimilation of the program.

*"You put the worksheet in [to request a change to the program], they'll tell you the cost of it and then you've got to have it approved, and how long will it take? Oh about four to five months, so you don't worry about it". (A:SnrAd: 165-166)*

*"Every month we made changes and then after a certain period of time those changes stopped happening so we were left with this half completed product". (B:Rdl 13-14)*

In terms of online data accessibility, radiology workers have found that external networks have improved since the implementation of the program. For example, with the new HIS, GPs are emailed the radiology report and therefore receive the information they require more efficiently [AFF-EXCH] [AFF-RELAT] [AFF-NETWORKS]. As one administrator stated:

*"After the report is dictated and transcribed it can be sent straight through to the GP, which is whey they [GPs] wanted". (B:Adm. 43-44)*

In summary, the affiliates dimension of the four dimension of the social actor framework, including the four constructs that describe this dimension, has provided a useful lens in which to understand both the enablers and inhibitors for the HIS assimilation process. In particular, the constructs of relationships [AFF-RELAT] and exchange [AFF-EXCH] are prominent from interviews.

## Findings

To answer the first research question, the analysis provided an indication that each of the four constructs within the four dimensions of the Lamb & Kling (2003) model had influenced the social actor during the assimilation process. The dimensions that have emerged as most prominent are those of *identity, interactions* and *affiliations*. However, the relevance of the *environment* dimension to the assimilation process is also apparent, particularly in relation to the technological and institutional practices or standards the company imposes on their members within each of the practices [ENV-MAND] and [ENV-POLICY]. Also, external factors such as the competitiveness of the industry and the shortage of skilled radiology workers in the Australian work force are also factors that have influenced the assimilation process of the HIS [ENV-MAND]. Further exacerbating problems during the assimilation process was the unreliable technological infrastructure [ENV-INFRA].

One of the major inhibitors during the assimilation process was apparent in the identity dimension, particularly in the constructs [IDN-DEFINE] and [IDN-PERCEP] as participants felt, without exception, that the assimilation process was fraught with problems, and the consequence was frustration, anxiety, depression, and in some cases, workers feeling the need to leave the company altogether. Job roles were also altered with the assimilation of the HIS, and although some embraced the change, others were not happy with the new tasks they were expected to complete, particularly the radiologists and radiographers [IDN-ROLES]. One of the major negative impacts for

practices during the assimilation process was the loss of valued and experienced staff due to the complexity and difficulties with the program [IDN-DEFINE].

Cultural rules and attitudes within the practices also influenced the assimilation process, as the principal researcher clearly observed the cultural divide between the various occupational roles of radiology staff. For example, the radiologists were treated with reverence by most within the practice, and many administrative staff and radiographers expressed a feeling of lack of support from radiologists during the assimilation process. There are three distinct groups in each practice and each has its own, unique social system and cultural attitudes. Although they work together well as a team in ensuring patient care, there are clear 'demarcation' lines between the three groups. The extent of this divide is greater in the metropolitan-based practices compared with the provincial-based ones; however, it clearly exists in all. The impact is felt negatively by the administrative staff who were expected to cope with the new HIS themselves whilst dealing with very angry and sometimes abusive radiologists, who expected them to drop whatever they were doing and solve their problems immediately.

Another major finding was the impact of interactions on the assimilation process. Interactions were identified as local (within the practice), across practices, and with external institutions such as referring GPs, patients and government agencies. There were both enabling and constraining contexts and constructs evident – in particular, the improvements in processing a patient during his/her visit [INT-PROCESS], compared with the lack of co-operation by radiologists and radiographers in validating patients throughout the process [INT-PROCESS]. The potential of the HIS was also recognised by most participants, especially in relation to the data available in the HIS [INT-CONNECT]. Reporting and patient histories was much improved with the new system. The only frustration was that much of the data was inaccessible to higher level management as they were not given access to create their own reports within the program, and more importantly, the parent organisation was simply not interested in helping middle-level managers obtain the data they needed [INT-SOCIAL].

Affiliations of the practice played a role in the assimilation process, and in the further evolution of the HIS once implemented. GPs need for a quicker turn-around time on their patients diagnosis were, for the most part, met [AFF-RELAT]; patients histories were accessible across the entire organization [AFF-NETWORKS]; and reporting to external agencies such as Medicare Australia was available through the program [AFF-EXCH]. However, technical hitches lowered the standard of some of the above benefits, particularly with regard to emails to GPs not arriving, and the inability of the HIS to 'flag' illegal entries that were then sent to Medicare (and consequently rejected). The greatest burden of the HIS however, was the continual slowing down or loss of the system altogether [AFF-MULTI]. This was particularly problematic during the first six (6) months of the assimilation process, and unfortunately, continues to the present day although to a lesser extent.

In answer to research question two, the case study illustrates the active role of social institutions in the assimilation of HISs and the utility of the concept of user as a social actor. The case shows that pre-existing structures such as organisational policy, mandates and practice culture play an active role in constraining and enabling human action in the use of an HIS, particularly in relation to the cultural and social systems within each practice, coupled with the expectations of individual actors. Social systems within individual practices of this radiology organisation have evolved around the value individuals, society and the parent organisation place on the various roles of radiology workers within a practice. For example, the radiologists are hierarchically at the top of the social spectrum and are aware of this. The radiographers fall in behind the radiologists and appear to both respect and yet, are cynical about the radiologists. For the administrative staff at the lower end of the social spectrum, there appears to be an expectation that they attempt to solve all other participants' problems as they arise and do so expediently. Consequently, administrative workers are the most competent users of the HIS and, due to this, are more accepting of the system as a whole. The mandates required by the company and other affiliates (GPs, Patients, Government agencies) also helped to mould the development, assimilation and evolution of the HIS over time. Most importantly, analysis of interview transcripts and observations when visiting each practice indicate a strong resentment towards the parent organisation in relation to their handling of the assimilation process. Two years later, the resentment is still strongly felt.

## Discussion and Conclusion

To conclude the case, we claim firstly that although providing a useful way in which to contextualise the factors that impact on the HIS assimilation process, in-depth data analysis and coding showed that some contexts are not clearly evident within the 16 characteristics of the four dimension framework. For example, the demographics of the social actor appeared to be significant during the initial assimilation process, namely, it was noted by a number of participants that the older radiology workers experienced the most difficulty with the new system when it was introduced. Hence, the new code [IDN-DEMO] has been added to the framework under the identities dimension. In addition, the geographic placement of the individual practices played a part in the assimilation process in terms of the culture and management of such practices. Further data collection and analysis is now needed to confirm these conclusions, and is currently underway. Although the individual demographics of radiology workers, and the

geographic position of the practices are not institutional constructs, and as a consequence, do not fit into the Lamb and Kling conceptual frame, as contexts they are relevant as inhibitors or enablers to the HIS assimilation process and require further research.

The second conclusion, and we believe, the major contribution of this research, is further evidence for the premise that the radiology worker is best conceptualised as a social actor and not a socially thin HIS user; and that there is an explicit link between individual actions and a larger social context. Not only has this research illuminated the applicability of the social actor framework at the individual, organisational and institutional level, but Lamb & Kling suggest that the four dimensions and the intertwined relationship between those dimensions and the social actor(s) will impact on the assimilation and consequences of HISs. In relation to the assimilation of the HIS within these three practices, the analysis demonstrated the impact of institutional constructs and contexts such as culture, politics, socio-economic pressures, and industry pressures. Further, at the individual level (social actors), their identities, their social networks, culture and politics in terms of social standing within the organisation were also illuminated. This was particularly evidenced in the sometimes individual, sometimes shared beliefs of the social actors, their identities, attitudes, interactions, beliefs and social systems. People are social actors (Lamb & Kling 2003) having some, but not complete, individual autonomy. Radiology workers live and act within a shifting set of social norms that shape behaviour in subtle and direct ways. The contextual nature of this work means that the level of analysis is explicitly tied to larger context. As Avgerou (2002) notes, the social and organisational contexts of HIS use are often conceptualised as institutions – enduring social structures that can be both stable and changeable.

Finally, we claim that we have extended the existing social actor model in the field of information systems by identifying dimensions of HIS assimilation as a process of contextual interaction. We have shown that it is plausible to analyse the interview text by creating meaningful codes representing the four dimensions of social actor model. Furthermore, we have extended the framework of the social actor model by showing how it is applicable and transferable to another case situation – the health industry. We feel that this is an important contribution to social informatics research in general. We have also extended the results of previous HIS studies by describing HIS assimilation in terms of the interactions between people, the HIS and context.

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## Acknowledgements

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