Understanding the processes of Information Systems deployment and evaluation: the challenges facing e-health

A Thesis submitted for the degree of Doctor of Philosophy

by

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Dedication

In loving memory of my parents – Mr Akshay Kirti Butts and Mrs Nirmal Butts

Table of Contents

List of Tables

List of Figures

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Abstract

Information Systems (IS) innovations in healthcare sector are seen as panacea to control burgeoning demand on healthcare resources and lack of streamlining in care delivery. Two particular manifestations of such innovations are telehealth and electronic records in its two forms: the electronic medical records and the electronic health records.

Deployment efforts concerning both of these IS-innovations have encountered a rough terrain and have been slow. Problems are also faced while evaluating the effectiveness of innovations on health and care delivery outcomes through strategies such as randomised controlled trials-particularly in case of telehealth. By taking these issues into account, this research investigates the issues that affect IS innovation deployment and its evaluation.

The strategy adopted in this research was informed by recursive philosophy and theoretical perspectives within IS that strived to expound this recursive relationship. It involved conducting two longitudinal case studies that are qualitative in nature. The first study involved telehealth deployment and its evaluation in the UK, while the second case study involved the deployment of electronic medical/health records in the US. Data was collected through focus group discussions, interviews and online discussion threads; and was analysed thematically.

The results of this research indicate that there are nine issues that arise and affect the deployment and evaluation of IS innovation in healthcare; and these are design, efficiency and effectiveness, optimality and equity, legitimacy, acceptance, demand and efficacy, expertise, new interaction patterns, and trust.

These issues are attributes of relationships between the IS innovation, context of healthcare and the user. The significance of these attributes varies during the deployment and evaluation process, and due to iterative nature of IS innovation. This research further indicates that all the attributes have either direct or indirect impact on work practices of the user.

Glossary

ANT	Actor Network Theory
CHF	Congestive Heart Failure
CM	Community Matron
COPD	Chronic Obstructive Pulmonary Disease
CEO	Chief Executive Officer
CT	Computed Tomography
CSW	Community Support Worker
DoH	Department of Health
EHR	Electronic Health Record
EMR	Electronic Medical Record
EPR	Electronic Patient Record
GP	General Practitioner
ICT	Information and Communication Technologies
IS	Information Systems
IT	Information Technology
LTCs	Long-Term Conditions
NHS	National Health Service
PCT	Primary Care Trust
RCT	Randomised Controlled Trial
RN	Registered Nurse
SCOT	Social Construction of Technology
SST	Social Shaping of Technology
ST	Structuration Theory
STS	Science and Technology Studies
TFR	Technology frame of reference
UK	United Kingdom
US	United States (of America)

Author's Declaration

This research contributed to the following publications:

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Chapter 1: Introduction and Overview

This chapter presents the research aims of this study including the research question and the objectives. It then presents background to the research by outlining its scope and rationale. Relevant terms are defined and the approach that this research followed is discussed. The chapter concludes by providing a description of chapters that follow.

1.1 Research Aims

The question that this research asks and has endeavoured to answer is:

> *How can the challenges that are encountered by the processes of IS innovation deployment and its evaluation in healthcare, be better understood?*

The objectives of this research are:

1. *Review literature with two purposes in mind. Firstly, to understand the various ways in which IS innovation, the context and the user are conceptualised in IS and healthcare literature. Secondly, elicit the way in which the nature of relationship between these three entities is conceptualised and how a meta theory can provide insight into the complexities of IS deployment and its evaluation processes.*

2. *Informed by the literature, develop a conceptual framework that facilitates understanding of various issues resulting from the deployment and the evaluation of IS innovation in healthcare.*

3. *Explain the choice of research philosophy, research method, data collection and analysis methods.*

4. *Evaluate the 'trustworthiness' of the conceptual framework through multiple longitudinal case studies.*

5. *Provide theoretical, methodological and practical contributions to the field of IS and healthcare (in particular, to e-health)*

6. *Identify areas for future research*

These objectives are addressed in the five chapters of this thesis that follow.

1.2 Research scope and rationale

The need for IS innovations in healthcare is driven primarily due to the extreme and

disproportionate pressure on healthcare resources and the escalating costs needed to maintain care delivery while meeting the desired standards and public health demands. This need also calls for the evaluation of effectiveness of the IS innovations (Greenhalgh and Russell 2010, Cornford, Doukidis and Forster 1994).

To facilitate deployment and evaluation of IS innovations, many incentives have been attempted. For example, in the U.K., a fund of £80 million was set to be invested for procuring and establishing IS-innovation based services between the year 2005-2008, while another £30 million was invested for evaluation of such services through the Whole Site Demonstrator project and its Action Network (DoH 2010, Barlow, Burn and Lockhart 2008). Similarly, in USA, special health care reforms resulted in warranting new policies pertaining to IS innovation procurement (PCAST 2010).

However, despite such efforts to provide monetary incentives and policy changes, the integration of IS innovation into the care delivery service has been rather disappointing and slow (Anderson 2007, Barlow, Burn and Lockhart 2008, Davidson and Heslinga 2007, Heeks 2006). This holds true despite numerous academics and independent researchers favouring the use of such innovation in healthcare to contain overall cost and improve healthcare outcomes (Cruichshank 2010). One argument explaining this predicament is that both the IS innovation deployment and the evaluation processes are instigators of change, which is often enabled and occasioned through management in response to external pressures. However, such change is resisted by those agents directly affected, such as healthcare professionals, due to perceived impact on personal work practices and overall care delivery processes (Davidson, and Chismar 2007, Lapointe and Rivard 2005). Two particular manifestations of IS-innovations that are noteworthy in experiencing such resistance are the telehealth and electronic records (electronic medical record /Electronic Health Records (EMR/EHR)). These are variants of e-health.

1.2.1 Defining E-health, telehealth, electronic records and randomised controlled trail
In this section, e-health and its variants: the telehealth and electronic records, and an evaluation strategy of randomised controlled trial are defined.

E-health
E-health is broad term used to encompass the use of information technologies in delivering

healthcare. This includes telehealth (remote patient monitoring), telemedicine, electronic records and use of web based applications (Bratan 2007, Eysenbach 2001). In this thesis, the focus is on two different e-health applications: telehealth and electronic records.

Telehealth

Telehealth accomplishes delivery of care by means of telecommunication technology (Sharpe 2001, Wootton, Dimmick and Kvedar 2006, Whitten 2006). It involves installation of equipment at the patient's home to allow the clinician (nurse, doctor or a medically trained technician) to monitor for any deterioration in the patient's health, commonly those with long-term chronic conditions such as chronic heart failure (CHF). The equipment is connected to peripheral devices which the patient uses to measure daily physiological parameters. These may include blood glucose monitor, blood pressure monitor, weighing scale and electrocardiogram (ECG). These parameters are then transmitted to the clinician, who assesses the trends in the patient's health and decides on appropriate intervention which might include a home visit or phone consultation. A telehealth service can be configured in many ways such that the level and complexity of technology can vary from simple phone calls through to the use of videoconferencing. There is an equal range of complexity of the service provided alongside telehealth equipment (where, service means the support network of clinicians involved in delivering care to the patients).

Reported advantages of telehealth from the institutional point of view include improved clinical outcomes (Clarke *et al*., 2005, Clarke, Shah and Sharma 2011), reduced number of unplanned hospital and A&E admissions (Barlow *et al*., 2005, Clarke, Shah and Sharma 2011). From the healthcare professional point of view, telehealth enables monitoring of their patients' health in a longitudinal sense and allows them to deal with case load more efficiently; and from the patients' view, it enables them to be more independent and self-manage their conditions (Fitzgerald, Piris and Serrano 2008).

Reported disadvantages of telehealth include procurement and deployment cost, lack of guidelines on deployment and evaluation procedures, changes in the context of care delivery, clinical encounter, and work practices (Peddle, Lehoux, May et al 2003a, 2003b, May 2007)

Electronic records

Electronic records, both EMR and EHR can be broadly understood as information systems that facilitate clinical decision-making based on evidence and aim at streamlining care (Boonstra and Broekhuis 2010, Greenhalgh et al. 2004, 2008, 2009). In practice, the

definitions have been used interchangeably which results in confusion. To differentiate dimensions such as scope, ownership, and interconnectivity are considered.

The scope and ownership of EMR and EHR can be defined separately. For example, it is understood that EMRs are created and maintained by the patient or institutions that have any involvement in the patient's care and therefore, are used by individual organisations (Clarke and Meiris 2006, Garets and Davis 2006). On the other hand, EHRs are used to collect data on the investigation and prevention of disease and the overall health (wholeness) of an individual over the course of their lifetime. These have much broader scope, of which the patient's EMRs health-related data are just a component and therefore, can span across many organisations. EHRs can be used in two ways (Clarke and Meiris 2006, Garets and Davis 2006). These can be used by the patient as their Longitudinal Health Records (LHRs) that are owned and controlled by individuals; and used by designated public health entities for health care research, health related public policy research, and overall health care systems research.

Furthermore, the EMR is considered to be a legal record that provides a longitudinal view of a person's health information in a specific system (Rector, Nolan and Kay 1991). EHR on the other hand is mostly used by the insurance companies as it provides the aggregate view of patient's health information from a number of organisations including social and mental institutes (Hayrinen, Saranto and Nykanen 2008, Mohammad 2010).

The difference in the connectivity requirements of the EMR and EHR enables further distinction between the two. The EHR requires to be interoperable so that EMRs of different organisations can be accessed, whereas EMRs require to be integrative so that departments within an organisations can be connected to provide an integrated patient health record.

The advantages of electronic records include streamlining care by ensuring the provision of information related to the clinical encounter and health updates to healthcare professionals, patients and the organisations involved, reducing chances of error in care delivery, and improving billing and reimbursement procedures (Anderson 2007, Boonstra and Broekhuis 2010, Hayrinen Saranto and Nykanen 2008, Yamamoto and Khan 2006).

Reported disadvantages of electronic records include failure to meet the specified requirements through technical design, high cost of deployment, change in work practices

and standardising care delivery (Boonstra and Broekhuis 2010, Hayrinen Saranto and Nykanen 2008, Mohammad 2010)

Randomised controlled trail (RCT)

RCT in healthcare is recognised as a gold standard among the various evaluation strategies, and is to be a method that enables "*determining whether a cause and effect relationship exists between the intervention and the outcome under examination*" (Davies and Newman 2011:7). A simple RCT can be depicted as shown in figure1:
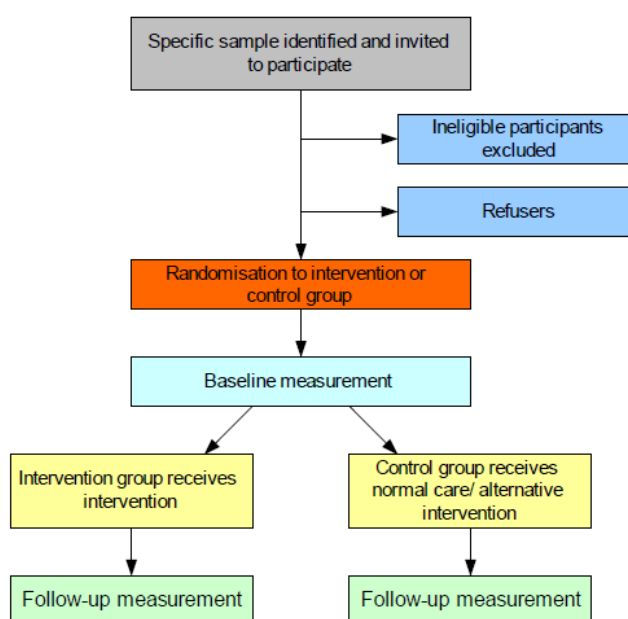
Figure 1: Simple RCT (Davies and Newman 2011: 7)

The strength of RCT is random allocation of participants and being blind or double blinded, thus, reducing the chances of bias and eliminating the potential impact of other factors other than the intervention. RCT enables to assess effectiveness of an intervention, both as enabler for improving current outcomes and cost. It also allows assessing user satisfaction, acceptability of an intervention and its safety (Davies and Newman 2011, Taylor 2005).

However, many challenges face RCT, and one of them is that RCT does not allow to assess how the processes of service delivery change due to intervention implementation in a complex context, thus making it less desirable as an evaluation strategy for technological intervention (Finch et al. 2003, Kaplan 2001, Lancaster et al 2010, May and Ellis 2001, May 2003b, May 2006a, 2006b, May et al 2007b).

In addition, as RCT requires careful selection and randomisation of participants, delays are

often caused due to small number of participants meeting the eligibility criteria (McDonald et al 2006). This impacts its sample size and genrelasibility of its findings. Taking these issues on board, researchers have proposed alternative procedures and strategies to assess the effectiveness of technological interventions such as the telehealth and electronic records. These strategies include employing qualitative evaluation methods to assess the impact of intervention on various stakeholders, methods that recognise evaluation strategy as social-practice, and methods that enable taking contextual issues on board (Finch et al. 2003, Greenhalgh and Russell 2010, May and Ellis 2001, May 2003b, May 2006a, 2006b, May et al 2007b, Berg 2001, Kaplan 2001 Armstrong 2006, Anderson and Aydin 2005, Lewin, Glenton and Oxman 2009, Murray et al 2011).

1.2.2 Problem definition

Given that despite the deployment and evaluation efforts pertaining to both of these IS innovations, backed by government and promoted as services that embody all the advantages and potential benefits, are still struggling to be integrated into main stream healthcare delivery services (Mair et al 2007, May, et al 2001, 2003a, 2003b, 2005), it is of interest to understand why their integration into main stream services is difficult. This research therefore, follows two case studies of telehealth deployment and evaluation, and electronic record deployment to gain insight into the complexities of such efforts and the way in which such efforts are articulated and perceived by the healthcare professionals.

From a theoretical point of view, this research uses healthcare as a context in which theoretical perspectives are explored and expanded upon. It is further reminded that theoretical contribution has generally been very low in the field of healthcare (Whitten et al. 2007, Chiasson and Davidson 2004, Gammon et al. 2008).

1.3 Research design and approach

In this thesis, the author explores and collates knowledge from various perspectives encompassed within Information Systems (IS) literature and healthcare/medical informatics literature to define the context where change was taking place as the healthcare social system; the technological content through which the change was instantiated as IS-innovation; and the user by whom the change was to be accepted as a human agent. It further facilitates to understand the following:

- What *is the nature of the relationship between the form of the healthcare information*

systems innovation, the healthcare social system as a context in which IS innovation is deployed, and the human agent by whom it is intended to be used?

- *Are there any attributes that can be attached to this relationship?*
- *Does the significance of attributes change when IS innovation is evaluated compared to its deployment without evaluation?*
- *What implication does the nature of IS innovation have on attributes?*

This research establishes that a recursive relationship exists between the entities and accords with theoretical frameworks developed by others (Giddens 1979, 1984, Orlikowski 1992, 2000, Pettigrew 1985, 1987). This approach supports multilevel analysis and takes into account the processual nature of IS innovation deployment and evaluation efforts (Markus, Daniel 1988).

The research involved conducting two case studies using qualitative methods of data collection that included focus group discussions, interviews, and taking online discussion forums as documents. The choice of research method, data collection methods and data analysis method was made according to the research philosophy discussed in detail in chapter 3.

1.4 Structure of the thesis

Chapter 2, provides a review of the theoretical perspectives in the field of IS and healthcare. By drawing on these perspectives, a conceptual framework called, the Triality framework is developed and presented.

Chapter 3 presents the research philosophy and underlying beliefs that guided the way in which this research was conducted.

Chapter 4 is an empirical chapter that investigates the issues arising from the deployment and evaluation of telehealth. This is done longitudinally.

Chapter 5 is the second empirical chapter that investigates issues arising when electronic records are deployed using longitudinal data from an online discussion forum.

Chapter 6 considers the findings of the research. This is followed by discussion of the implications and limitations of the research, including consideration of future work, and the contribution of this research to the fields of IS and healthcare (particularly e-health). Finally, the author reflects on her personal journey as a researcher.

Chapter 2: Review of literature

2.1 Approach to literature review

The objective of the literature review is twofold. The first objective is to understand the different conceptualisations of technology, context and the user according to existing theoretical perspectives within IS literature and in the field of healthcare; and in addition, outline perspectives that have expounded the nature of the relationship between these entities. The exploration of such notions stems from the need to appreciate how these theoretical perspectives and concepts have been applied in the field of healthcare to understand technology deployment and evaluation processes by taking into account the tacit, ephemeral, and complicated nature of healthcare work practices.

The second objective involves drawing parallels between the two bodies of literature from IS and healthcare, and conceptualising a framework that can be employed to explain how and why technology deployment and evaluation processes in the field of healthcare cause many challenges to arise.

2.1.1 Chapter Outline

The chapter starts by drawing on well known theories in the field of IS to study deployment processes. These include the social construction of technology (SCOT), actor network theory (ANT), diffusion of innovation, contextual approach and the structuration theory, and its derivatives in the field of IS. By drawing on these perspectives, a conceptual framework is developed and presented, and outlines the salience of considering technological content, context, and user as three entities, each interrelated to the other through a recursive relationship.

In the second section of this chapter, theories and concepts that provide understanding on the impact of deployment and evaluation processes in the field of healthcare are presented. These include normalisation process theory (NPT), routinisation theory, the structure, process and outcome framework and, concepts such as virtual and invisible work. By drawing on these theories, the micro-dynamics that occur between the context, the technology and the user, and which, in this research are considered as the *attributes* of the recursive relationships between the three entities, are identified. This leads to the final iteration of the proposed framework, called the Triality Framework. According to this framework, the technology is conceptualised

as IS innovation, the context is conceptualised as healthcare social systems and the user is conceptualised as human agent. It further highlights that each recursive relationship has a set of attributes associated with it; and in this research these attributes are used to elicit the complexities associated with the healthcare context and the dilemmas that present to healthcare professionals when IS innovations, such as telehealth and electronic records, are deployed and evaluated.

2.2 Theoretical perspectives from the field of IS: Understanding conceptualisation of technological content, context and user, and the nature of interrelationship between them

Exploring theoretical perspectives from IS provides insight into how technological content, context and the user have been conceptualised, and what is the nature of relationship between the three entities. Theoretical perspectives that are of essence in relation to the problem addressed in this research are discussed next.

2.2.1 Social construction of technology (SCOT)

SCOT stems from science and technology studies, which concern themselves with the impact of technology on society and its dynamics. These studies argue that the technology design and its acceptance trajectory are affected by social dynamics within a given society (William and Edge 1996). SCOT therefore, strives to explain why certain technological artefacts or "*variants*" rise in society at given point in time whereas the others "*die*" (Pinch and Bijker 1984: 411). This view was proposed in response to technology determinism that establishes an opposite perspective that technology impacts the surroundings and its users (William and Edge 1996). SCOT presents specific conceptualisation of technology, context and the user. These are discussed below.

Technology according to SCOT is conceptualised as an artefact of which the design and use is the subject of various interpretations resulting due to enabling and constraining properties of the technology as experienced by the groups under a given social context (Avgerou 2002, Bijker 1995, Klein and Klienman 2002, Pinch and Bijker 1984, Jackson, Poole and Kuhn. 2002). This constitutes the concept of interpretive flexibility, which also ascertains that despite different interpretations of an artefact within a society, these interpretations can co-exist together as they are dependent on desired outcomes.

In addition, the degree to which a technological artefact is accepted within a society is defined by the concept of closure and stabilisation. Closure is achieved when "*all groups' problems have been addressed and groups achieve consensus on a particular design*" (Klein and Klienman 2002: 39). Stabilization on the other hand, occurs when an artefact no longer requires high specifications. Closure can be attained in two ways, through rhetorical closure where the relevant social group sees the technology as solving the problem that it was intended to address, and closure by redefinition of a problem that sees the use of technology as the solution to an entirely different problem than originally proposed. For example, when the prelimatic tyre was originally introduced to solve the vibration problems in cycles, it was rejected; however, when used instead in racing cycles, it was accepted. This illustrates the closure by redefinition of the problem.

Context according to SCOT includes the social and political dimensions. It is argued to shape the values and norms of the groups. It does not however provide detailed insight into this area and has been criticised for this weakness.

The user in SCOT, is conceptualised as a member belonging to a particular social group, who despite sharing a common interpretation of technological artefact as a member of the group also has an individual interpretation which can be subjected to the group's scrutiny over time. This notion is constituted within the concept of technology frames, and has been regarded as its contribution. Another contribution of SCOT includes its attention to the influence of the designer on design during the design process.

However, its drawback includes the lack of acknowledging that the design of an artefact might be embedded with a particular group and their intention, and therefore may be unsuitable for other contexts and groups. Faulkner (2009) further argues that SCOT has been criticised for not considering user opinion and extrapolates findings by only following trends.

In the field of IS, SCOT is furthered by Orlikowski and Gash (1994), who introduced the concept of technology frames of reference (TFR) by drawing on Bijker's notion of the technology frame. According to TFR, the perceptions, expectations and experiences of an individual pertaining to a provided technology, constitute their view and attitude about its nature, value and use. Individuals are argued to have separate and different TFRs and these

are often created when a change is introduced that causes disturbance to established routines and work practices (Ciborra and Lanzara 1994).

In the case where the TFRs of individuals match, they are called to be in congruence such that "*alignment of frames on key elements or categories*" exists, but when there are differences, they lead to "*incongruence of technology frames*" (Orlikowski and Gash 1994: 180). Significant incongruence would result in technology being abandoned, while congruent technology frames would achieve use and become embedded in routines.

By drawing from SCOT and TFR, it can be argued that users of technology constitute perceptions as frames that are influenced by their interaction with their surrounding environment and group members (Davidson 2006, Davidson 2002, Davidson 1997). These frames govern their reaction to any change introduced and if congruent then positive impacts such as use of provided technology can be achieved. On the other hand, if incongruent frames dominate, the use of technology will cease and efforts to deploy or evaluate would be wasted. The notion of frames and the way in which SCOT conceptualises the three entities will be used later to define how context, technology and user is conceptualised in this research.

The focus now moves to ANT, which although a variant of STS, differs greatly from SCOT in terms of its analytical approach.

2.2.2 Actor Network theory (ANT)

In actor network theory (ANT), there is no analytical difference between a technology artefact and a human user (Latour 1999, Greenhalgh and Stones 2010). Both are described as actants that pose as an agency, and together aim at achieving a goal within a heterogeneous network, while drawing on artefacts, text, conventions such as money, people or a hybrid of these intermediaries.

An agency that is described as the technical artefact and human user is argued to be semiotically equivalent; which requires thinking symmetrically about human and nonhuman agents. Both Pickering (1993) and Orlikoswki (2007, 2008) favour the use of this notion and have extended it. For example Pickering introduced the notion of the 'Mangle of practice', according to which, he argues that the human agency and the machine agency are temporally emergent in practice, with the goals of the human agency governing the outcome. In other

words, human agency uses technology as its "*temporal extension*" and by which it can succeed in its endeavours. He further suggests that it is the interaction between the human agency and the machine agency which leads to resistance and accommodation.

More recently, using the underlying philosophy of ANT, Orlikowski (2007: 1438) introduced the concept of 'Cognitive entanglement', which "*presumes that there are no independently existing entities with inherent characteristics*". The entities in this statement pertain to the context, technology and the user. The notion suggests that there is no recursive relationship between the entities, and according to this approach the "*focus is on agencies that have so thoroughly saturated each other that previously taken for granted boundaries are dissolved*" (Orlikowski 2008: 20).

An approach encompassing such a perspective towards technology and human as a user is favoured because its argued it solves the problem of representation (Pickering 1993, Orlikowski 2007, 2008); which because of the subject object dichotomy employed within other perspectives, fails to acknowledge the issues arising due to power imbalance and shift in knowledge that occurs when a technological artefact is introduced within heterogeneous networks (Latour 1999).

A heterogeneous network in ANT is a reference to the context in which human-machine interactions are situated, (Law and Callon 1992). The context is governed by sociology of translation. Translation here refers to the processes and actions that are involved in achieving a result due to the interaction between the actants, and it depends upon irreversibility and alignment of the interests of the actors with the overall network aims and goals. In addition, it is suggested that networks are successfully translated when they conform to the regulation, norms (local) and are constituted by legitimate actors. Such translations allow networks to converge and therefore, be effective and durable (Avgerou 2001, 2002). This notion of sociology of translation is applied in the field of healthcare by Nicolini (2010) in his work to understand the adoption and assimilation of telemedicine innovation.

Among the main drawbacks of ANT is its analytical dimension in which human and machine agencies are treated as the same (Pickering 1993, Avgerou 2002). Labelled as the post-humanist approach, it is argued that the use of this analytical lens crumbles when the complexity and number of networks increases. In addition, it is debated that the context in

which both human and nonhuman actors interact is only acknowledged to be politically influenced and the social and cultural avenues are ignored.

However, the very criticism of ANT is also seen as its main strength as some argue that by using such an analytical concept, ANT accounts for negotiating, redefining and appropriation of interest of human actors and those "*inscribed within a technical artefact*" (Orlikowski et al. 1996). One example that used the notion of negotiation in healthcare is study where the implementation of telehealth is studied, and it is argued that the interaction resulting between context, information communication technology (ICT), and the user due to ICT implementation is a social process. It requires negotiating between power, politics and meaning encompassed within ICT and its intended use (this concept uses the term ICT instead of IS innovation) (Constantinides and Barrett 2006a, 2006b). The authors further argue that such emergent processes of negotiation can be studied by taking the context, ways in which ICTs are enacted and the different role of the technological artefact into account.

In addition, ANT provides important understanding about technology and its acceptance within networks. For example, through the concept of normalisation it highlights the longitudinal nature of technology acceptance by users in their routines (Avgerou 2002).

The concept of 'Unintended consequences' outlines that the outcomes of introducing technology in a network might not always be desired and expected, and that unintended ways of technology use increases when users and designers are spatially absent or distanced (Nicolini 2007). One study using this concept in healthcare (Harrison, Koppel and Bar-lev 2007) suggested that unintended consequences can be attributed to the change introduced by the healthcare information technology (HIT) implementation, and that the role of such unintended consequence can be assessed by evaluating five types of sociotechnical interactions, shown in the form of an interactive sociotechnical analysis (ISTA) model-figure2. The model allows examination of the actual use of HIT, the impact of the technical and physical settings of work on HIT, users' interpretation of HIT use, and the recursive dependence of these factors on each other.
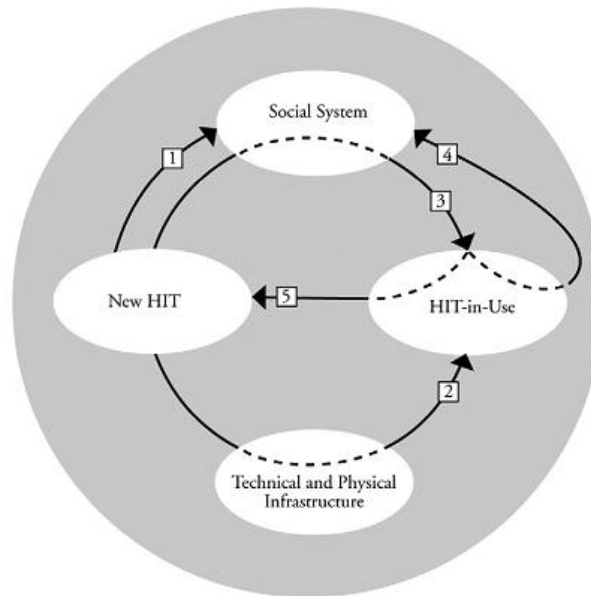
Figure 2: ISTA model (from Harrison, Koppel and Lev 2007)

These notions emerging from the use of ANT are used in this thesis to contribute towards conceptualising the context, technology and user more holistically.

The focus now moves to another theoretical perspective, diffusion of innovation, which provides a valuable understanding on how technology diffuses within a society.

2.2.3 Diffusion of innovation

In this perspective, technology is conceptualised as innovation where innovation is encompassed in a broad definition as "*an idea, practice, or object that is perceived as new by an individual or other unit of adoption*" (Rogers 2003: 6,12). An innovation is argued to have five attributes of: relative advantage, compatibility, complexity, trialability, and observability. The definition of each attribute is presented in table1.

Relative advantage

   "is the degree to which an innovation is perceived as better than the idea it supersedes"

Compatibility

   "is the degree to which an innovation is perceived as being consistent with existing values, past experiences, and needs of the potential adopters"

Complexity

"is the degree to which an innovation is perceived as difficult to understand and use"

Trialability

"is the degree to which an innovation may be experimented with on a limited basis"

Observalibility

"is the degree to which the results of an innovation are visible to others"

Table 1: Five attributes of innovation (taken from Rogers 2003: 16)

Innovation as technology is also suggested to be a composite of hardware and software, and an enabler of accomplishing actions to achieve desired goals.

The context according to this perspective is a social system consisting of social structures and norms. The structures are a type of information that regulate the individual's behaviour and are defined as "*patterned arrangements of units in a system*". Norms on the other hand are defined as regularised behaviour patterns that are acceptable. The notion of a social system is inclusive of an organisation or a network of organisations. When an innovation is proposed, an organisation is argued to go through a process of innovation which, involves defining organisational need, matching the need with an innovation, going through the process of redefining and restructuring the innovation and organisational routines to achieve fit, clarify if any gaps remain, and finally achieve routinization where innovation is accepted with activities such that it "*loses its identity*" over time (Rogers 2003: 421, Lee 2004).

The user, according to this perspective is understood to be an individual who is a part of the innovation-decision process that involves mapping the journey of an individual through gathering knowledge on the innovation, developing a perception towards the innovation, evaluating and taking the decision to either accept or reject the innovation, use the innovation, and finally confirm the decision (to use it or not). The user is also conceptualised to communicate his/her understanding about the technological innovation to the other individuals within the social system, thus, impacting its diffusion.

One of the main contributions of this perspective is the concept of consonance and dissonance, which argues that an individual's behaviour is attributed to their constant effort towards eliminating or reducing the uncomforting feeling due to change. In IS, this notion is used to understand how use of IT changes work practices at a micro level, and how practices

change due to perceived dissonance between the context, technology and the action entailed within practices. Overtime, individuals enact practice as routines to experience consonance (Vaast and Walsham 2005).

This perspective also proposes that the change in social structures and norms due to the introduction of innovation leads to resistance (Greenhalgh al. 2008). Using this perspective to understand the diffusion of electronic records in the NHS. U.K. resulted in a conceptual model that considers "*the determinants of diffusion, dissemination, and implementation of innovations in health service delivery and organization*" (Greenhalgh et al 2004: 595, Greenhalgh et al 2008).

This perspective and how it had been used by other authors to understand the processes that impact diffusion of innovation provides a valuable contribution to the framework in this work to conceptualise the context, technology and user.

We now move our attention to the Contextualist approach. This approach argues that a relationship exists between context and the content.

2.2.4 Contextualist approach

The contextualist approach elucidates the importance of considering context when studying change and the processual nature of such a change. According to this approach, context is conceptualised to consist of outer and inner contexts. The outer context refers to inter-organisational conditions such as political, social, economical and competitive environment (Pettigrew 1997, Pettigrew 1987, Pettigrew 1985). On the other hand, inner context accounts for intra-organisational aspects such as structure, organisational culture and political circumstances.

In IS, the contribution of the contextualist approach is considered important as defining the context can be often problematic (Avgerou and Madon 2004); and by extrapolating this notion to IS, context can be defined as a set of variables that affect information systems and in turn are influenced by it. This is termed "*the environment*", and informs that context should be considered as emergent (Avgerou 2001).
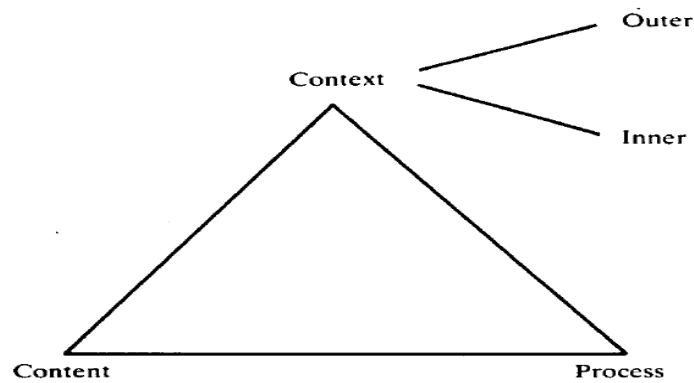
Figure 3: Contextualist Framework

Conceptualisation of technology according to this perspective is that of a content that can be understood as "*the particular areas of transformation under investigation*" (Pettigrew 1987: 657). Apart from introducing new technology, when viewed from the perspective of organisational context, these areas of transformation can also include geographical positioning, change in organisational culture and work force. It may be further argued that content and context are bound in a mutual relationship, where one is continually shaped by and shapes the other. Outlining the recursive relationship between content and the context is one of the contributions of this approach (Pettigrew 1997, Pettigrew 1987, Pettigrew 1985).

The relationship between context and content is enabled through process, where process encapsulates the actions, reactions and interactions of the various parties that are involved in changing of an organisation from one state to another (Markus and Daniel 1988, Pettigrew 1987). Thus, it represents continuity and interdependent sequence of actions and events related to a given phenomena and allows understanding of its (phenomena's) origin, continuance and resultant outcome. At an actor level, process is represented and described by verb forms such as interacting, acting, reacting, responding and adapting. Whereas, at a system level, emerging, elaborating, mobilizing, continuing, changing, dissolving and transforming describe process.

The strength of the contextualist approach lies in the provision of "*guiding assumptions*" to carry out the research appropriately (Pettigrew 1997: 340). Among these assumptions is the inclusion of vertical and horizontal analysis. It is argued that having multiple levels of analysis enables the emergent and situational nature of process under the given context to be captured. Analysis at the vertical dimension includes studying group dynamics and organisational issues, and the interrelationship between those levels. Horizontal analysis

involves interconnecting longitudinally the phenomena of interest studied at the vertical level (Pettigrew 1987, Pettigrew 1990, Pettigrew 1997, Pettigrew, Woodman and Cameron 2001, Walsham and Waema 1994, Walsham 1993). Such form of analysis suggests that a theory or theories can be used as a motor to drive analysis, and that the processes under analysis should be linked to the outcome.

In IS, this approach is adhered to link content, context and process to the "*'what', 'why' and 'how' of evaluation*", where it is argued that "*effective evaluation requires a thorough understanding of the interactions between these three elements*" (Symons 1991). In the field of healthcare, the contextualist approach is used to understand the adoption, use and diffusion of telehealth, and it is argued that the contextualist approach through its characteristic of facilitating multi-level analysis allows the researcher to "*study network-level innovations involving multiple organizations and stakeholders*" (Cho, 2007: 15).

This perspective offers a valuable contribution to Triality framework as it confirms the recursive relationship between the entities, context and technology.

The focus now moves to structuration theory which introduces the concept of 'Duality of structure', emphasising that there exists a relationship between the context and the user.

2.2.5 Structuration theory
According to structuration theory (ST), the changes in social systems are not simply an outcome of either human action (subject to knowledgeability) or social structures, but a product of their interaction. This relationship of simultaneous mutual shaping is known as the 'Duality of structure', which is "*that the structural properties of social systems are both the medium and the outcome of practices that constitute those systems*" (Giddens 1979: 69). In other words, there exists a recursive relationship between the user (in this theory called human agent) and the context (in this theory termed social system), and thus, it offers a valuable contribution to Triality framework as it confirms the recursive relationship between context and the user. Understanding this reciprocal and recursive relationship involves three main concepts: the social system, structure and the human agency.

Social systems are expressed as the reservoir of recursive social practices that human agents perform during their daily lives. In modern social system, these practices are institutionalised thus constituting deeply embedded routine work. Change to these routines is resisted. The

rules and resources that human agents draw on, and simultaneously enact while accomplishing their daily routine through interaction within the social systems, are known as structures. Structures do not exist in time and space as social systems do, but reside in human "*memory traces*". Therefore, structures are solely dependent on human engagement, and at the same time are both, the facilitators and the constrainers of this engagement (Giddens 1979, 1984).

Both, the structure and human interaction encompass three dimensions and these are interlinked by three modalities in the 'Duality of structure' as shown below in figure 4. Each structure has dimensions of signification, domination, and legitimation and each interaction has dimensions of communication, power and sanction. By the structure of signification, Giddens refers to the structures of meaning that human agents enact by drawing on their interpretive scheme, through communication, to evaluate the underlying motive of their actions and those around them. The structure of domination is enacted when human agents exercise power through facilities such as ability to locate resources (Walsham 1997, Walsham and Han 1991). The structure of legitimation is enacted when agents assess their actions and sanction them through norms (morality and ethics).
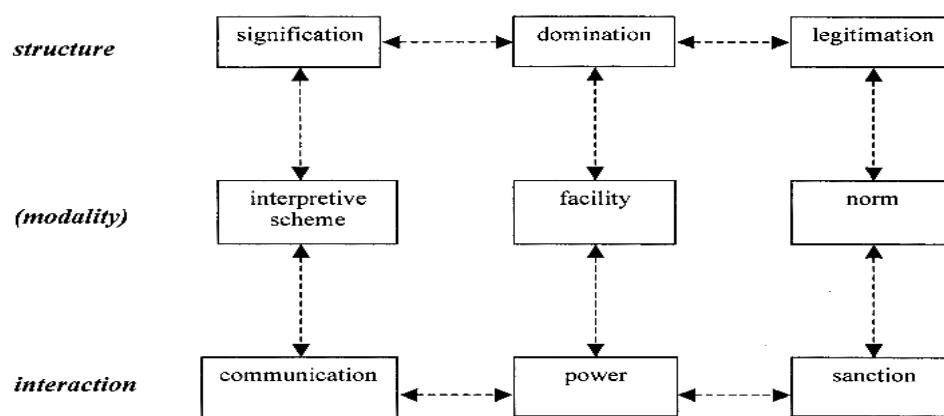
Figure 4: Structuration theory (taken from Giddens 1984: 29)

The production of new and reproduction of old structures through human interaction implies that human agents have an inherent capacity to act and transform. This capacity to act is called the 'agency'. The same capacity is understood as transformative capacity when the agency is exercised with power, which is an integral part of an agency. Human agency is also reflexive, that is human agents continually monitor their actions and that of others. Certainly,

in order to enact new routines, the agents utilise reflexivity and transformative capacity to enhance their knowledgeability, that in turn, reciprocate their decisions (Giddens 1979, 1984, 1990, 1991)

The structuration theory has been widely acknowledged in various fields, and especially in IS (Jones, Orlikowski and Munir 2004, Sharma, Barnett and Clarke 2011). However, there are challenges that need to be overcome when using this theory, and these are described next.

The first challenge faced when using structuration theory is that it encompasses number of concepts that are used to elucidate the 'Duality of structure'. This affects the applicability of ST in the field of IS, and presents a dilemma of whether to use the theory in its entirety (as a meta-theory) and risk abandoning salient concepts, or use specific concepts and risk losing its overarching perspective (Walsham and Han 1991, Thompson 2004, Jones and Karsten 2008). However, one solution is to use specific concepts to facilitate detailed and meaningful exploration of a problem.

The second potential challenge of applying ST to the area of IS is its lack of focus on technology (DeSanctis and Poole 1994, Pozzebon and Pinsonneault 2005). This can be mapped onto adopting a nominal view about technology (Orlikowski and Icano 2001). Many IS researchers have acknowledged this as a critical gap and have provided ways in which this can be addressed (Barley 1986, Orlikowski 1992, 2000). These efforts are described next.

The Scripts
One of the first examples of the use of ST to study the effects of technology introduction was to expound how the computed tomography (CT) scanners introduced in the radiology department of two hospitals enabled enactment of different structures (Barley 1986). However, in order to overcome the lack of emphasis on technology in structuration theory and its effect on the interaction between agents and thus the structures enacted, the technology was defined as "*an intervention into the relationship between human agents and organisational structure, which potentially changes it*" (Orlikowski and Baroudi 1991: 6).

Moreover, by drawing on the duality of structure, other peripheral concepts within ST were diminished and the concept of 'scripts' was introduced, which was termed as "*observable, recurrent activities and patterns of interaction characteristic of a particular setting*" (Barley

and Tolbert 1997: 98). This allows the link between action and institution to be explored using structuration theory and organisational theories, with a resultant sequential model of institutionalisation that has four "*transition states*" or moments based on scripts: encode, enact, replicate or revise and, externalise and objectify. These being a representative of practices that are enacted and in the light of changes, they are replicated or revised and eventually become part of daily routine or institutionalised.

Key: a = encode, b = enact, c = replicate or revise, d = externalize and objectify
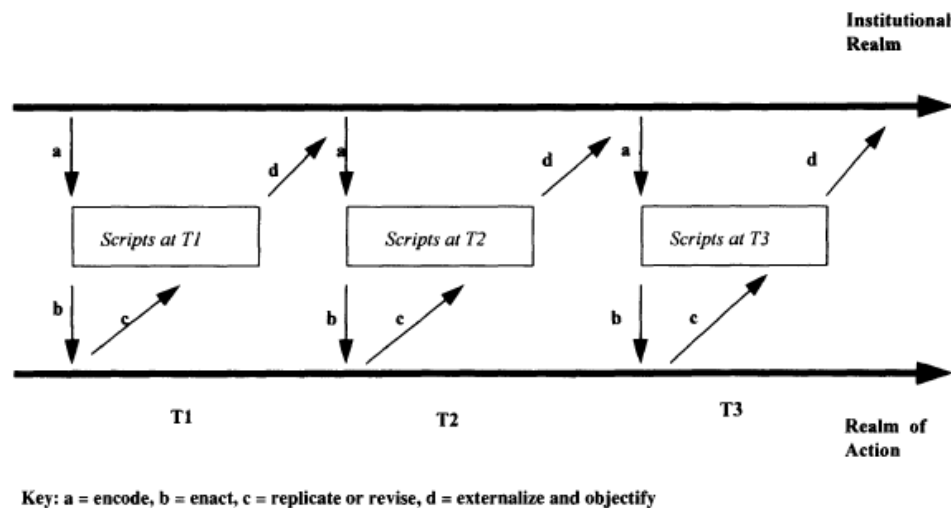
Figure 5: Production and reproduction of scripts: Institutionalization model (From Barley and Tolbert 1997: 101)

The institutionalization model may be extended to explore the relationship between deployment of new technology and expertise (Black , Carlile and Repenning 2004). This was achieved by applying mathematical modelling to ethnographic data, to determine how differences in the expertise of users affect their willingness to collaborate with others. It is suggested that enhancing users' knowledge on using technology does not necessarily guarantee its use and improved outcome. Instead, the success of technology is related to distribution of expertise amongst the users, where, the concept of relational distribution is explained as "*a relative balance in operational knowledge*" (Black, Carlile and Repenning 2004: 601).

Technology-in-practice
In 'Duality of technology', the technology is considered as an artefact embedded with structure, where structures are defined as the "*mental models*" that human agents enact while drawing on the rules and resources available to them and interacting with colleagues and the environment (Giddens 1984, Giddens 1979, Orlikowski 1992). An artefact is described as a tool that may be employed for intended use or other purposes, some of which may be

completely unrelated to the original (Orlikowski and Iacono 2001). Furthermore, it is the user's contextual surroundings that might influence the way in which the tool is used or allow for its use to be re-invented (Orlikowski 2000, Constantinides and Barrett 2006a 2006b, Pettigrew 1987).

However, the idea of an artefact embedded with structures contradicts the emergent use of technology and therefore, Orlikowski proposed an enhanced view in 2000 in which she proposed technology-in-practice lens that distinguishes between technology not in use and technology in use. According to this lens, it is argued that technology is to be considered as an artefact when not used but, when agents in their daily routines use technology, it becomes 'technology-in-practice', where structures of technology use are enacted by agents while they use and interact with a given technology in a given context (Orlikowski 2000).

The phenomenon of emergent technology-in-practice was studied in three different organisations, all using the same technology (the Notes), and identified three types of enactment and six types of technology-in-practice (Orlikowski 2000, Orlikowski and Barley 2001, Orlikowski 1993). It is observed that the types of enactments (structures enacted) are distinguished by the degree or extent of change in the process, technology or structure (context), which are termed as "*interactional, technological and institutional consequence*" respectively. Change in technology would result in the first type of enactment, "*inertia*", which is characterised by limited-use technology-in-practice. Change in technology and process would result in "*application*" as enactment and could involve collaboration, individual productivity, collective problem solving and process-support as technology-in-practice. The third type of enactment, "*change*", would involve improvisation technology-in-practice and is usually observed when there is a significant modification of the process, technology and structure.

This aspect of Orlikowski's work has been extended and highlights its dynamic nature (Bourdeau and Robey 2005). A change in enactment is introduced as "*improvised learning*" and while supporting the concept of inertia, the term "*reinvention*" is introduced to explain working around a new system in "*unintended ways*" (Boudreau and Robey 2005).

This perspective offers a valuable contribution to Triality framework, as it confirms the recursive relationship between the technology and the user.

The perspectives discussed in this section can be summarised and by invoking further concepts provide a holistic conceptualisation of technology, context and user, and at the same time provide understanding of the deployment and evaluation efforts in the field of healthcare.

Theory	Conception of context	Conception of technology	Conception of the user
Social Construction of Technology	*Social context – society that is politically and economically influenced*	*Artefact (designed)*	*Social group comprising of individuals*
Actor Network Theory	*Politically driven-power play*	*Actant with semiotic agency*	*Actant with semiotic agency*
Diffusion of innovation	*Social system inherent to which are structures and norms*	*innovation*	*Individual with goals to achieve and ability to learn and draw on experiences*
Contextualist approach	*Inner and outer*	*Content*	*Actor whose interacting, acting, reacting, responding and adapting*
Structuration Theory	*Social System*	*-*	*Human agent with an agency, and who is always involved in reflexivity of actions*

Table 2: Conception of context, technology and user according to different theoretical perspectives

2.2.6 Conceptualising technological content, context and the user

Section one has presented theoretical perspectives to provide an understanding of the conceptualisation of technology, context, the user and the nature of relationship between them. Taking the essence of these perspectives into account, this research conceptualises technological content as IS innovation, context as healthcare social system, and the user as human agent. It further argues that a recursive relationship exists between each entity. This results in a conceptual framework that combines the congruent relationships, and enhances the common. This framework is called the Triality framework.

Conceptualising technological content as IS-innovation

The term IS innovation is used in this thesis to represent 'technology' in the Triality Framework as it ensures that technology is understood not just as an artefact, but rather a modality with emergent and dynamic use. Furthermore, although the IS innovation may be embedded within an overall vision, the way it is to be used is not fixed, and users may alter or modify it. This not only accounts for the attributes of innovation as outlined by Roger (2003) but also provides an explanation of the ways in which human agents in social systems enact practices, and how the process of enactment is facilitated through using IS innovation as a mediator, where its use can be improvised through the ability of the agents to learn and circumnavigate (Orlikowski 2000, 2002).

This conceptualisation approach takes into account both the proxy and ensemble view of technological artefact. The proxy view refers to "*focus on one or a few key elements in common that are understood to represent or stand for the essential aspect property or value of the information technology*" whereas, an ensemble view focuses on "*dynamic interactions between people and technology whether during construction implementation or use in organizations or during the deployment of technology in society at large*" (Orlikowski and Icano 2001: 124, 126). Moreover, ensemble view is highly apt for a complex context as healthcare (Chiasson and Davidson 2004).

This notion also supports the view that where an innovation is considered to be a part of social change, it may be an enabler and a constrainer of actions due to various institutional, organisational, social, rational and idiosyncratic reasons (Avgerou 2001, Avgerou and Madon 2004).

The IS innovation term further includes the property of 'informate' where information technology possesses the duality whereby through its ability to automate the organisational transactions it also "*create(s) a vast overview of an organisation's operations, with many levels of data coordinated and accessible for a variety of analytical efforts*" (Zuboff 1988: 9)

Conceptualising context as healthcare social system

The introduction of technology in healthcare system introduce a number of changes to overall healthcare delivery, including the context where care is delivered and the way in which it is delivered (Boddy et al 2009). This can result in factors contributing to conflict among its users and contradiction in overall goals (May 1993, May et al. 2001, May and Ellis 2001, May et al. 2003a, May et al. 2004, May et al. 2005, Whitten and Adams 2003, Whitten and Mickus 2007, Whitten, and Mackert 2005, Wootton et al. 2006). Studying and understanding such contextual changes can be facilitated by using ST and high modernity (Gammon et al. 2008, Hardcastle, Usher and Holmes 2005, Kouroubali 2002, Lehoux, Sicotte et al. 2002, Peddle 2007, Walsham 1997, Whitten et al. 2007). However, to apply this approach appropriately, IS innovation based services such as telehealth and electronic records have to be seen as an extension of a healthcare social system that spans across time and space. For this, Giddens's definition of social system and concept of disembedding mechanism will be called upon.

As a healthcare system involves institutionalised practices, and by recalling the definition of a social system presented earlier (in SCOT, diffusion of innovation and ST), it is argued that a modern healthcare system can be perceived as a large social system that contains individuals interacting with each other, and whilst doing so, they enact various structures through continuous reflexive monitoring of their actions. Endogenous to these social systems are the disembedding mechanisms, to which, Giddens alludes as ""*lifting-out" of social relations from local contexts of interaction and their restructuring across indefinite spans of time-space*" (Giddens 1990: 20). The concept of disembedding mechanisms was introduced by Giddens in Consequences of Modernity (CM), whereas opposed to his earlier work, Giddens reflects on the role of technology as a facilitator and contributor to the "*stretching*" of modern social systems (Giddens 1990, Giddens 1991).

There are two types of disembedding mechanisms, symbolic tokens and expert systems, which collectively are termed as abstract systems (Giddens 1990). Symbolic tokens such as money are defined as "*media of interchange which can be "passed around" without regards*

to the specific characteristic of individuals or groups that handle them at any particular juncture" (Giddens 1990: 22). Expert systems on the other hand are described as "*systems of technical accomplishment or professional expertise that organise large areas of the material and social environments in which we live today*" (Giddens 1990: 27).

Comparing these definitions, technology can be understood as an expert system that combines "*technical accomplishments*" of equipment such as telehealth and electronic records with "*professional expertise*" of clinicians aimed at organised delivery of care for patients in a modern healthcare system.

It is not clear why the two disembedding mechanisms taken together should be called an abstract systems, and therefore this research uses a modified definition where an abstract system is depicted to encompass an expert system organised and structured around care delivery processes. This modified perspective has two inherent advantages. From a theoretical point of view, it acknowledges all the pivotal concepts related to the abstract system without losing its central meaning (no interdependence is ascribed between the expert system and the symbolic token by Giddens, therefore subtracting symbolic tokens from abstract system studied should not affect its functionality). From a practical view, this perspective allows the contextual differences between traditional care delivery practices and technology based practices to be distinguished.

As an expert system, technology based healthcare delivery services create systems where the experts within the system meet lay people (Giddens 1990) (in our study the experts are clinical users and the lay people are patients). The interactions within such systems are based on trust and expertise.

Within this research, the 'context' may be substituted as the 'social system' which better describes a setting such as healthcare. Furthermore, using the term 'healthcare social system' in place of 'context' in the Triality framework acknowledges that modern organisations are extensions of social systems, and enables various dimensions such as political, economical and social conditions to be incorporated in the definition of context (Pettigrew 1987, Van de Ven and Garud 1993).

This approach also provides understanding of the dynamics of technology deployment and organisational discourse as instigator of social change (Avgerou 2001) and as an interacting entity (Dopson, Fitzgerald and Ferlie 2008).

Conceptualising user as human agent

The user of technology has been defined within IS deployment research as an actor with habitus[1], such as in ANT (Schultze and Boland 2000, Latour 1999). In this research, the term 'human agent' is considered more appropriate as it acknowledges that humans have an 'agency' that is their inherent capacity to act. This 'agency' is engaged in reflexivity where each action taken is reflected upon and learned from. By doing so, the human agents enact new routines and employ transformative capacity (power) to enhance their knowledgeability (Giddens 1984, Edmonson, Bohmer and Pisano 2007). The term "agency" also enables intentionality and choice to be considered. It may also be argued that despite the constrictive nature of context; agents have freedom of choice as "*people are purposive, knowledgeable, adaptive, and inventive agents who engage with technology in a multiplicity of ways to accomplish various and dynamic ends. When the technology does not help them achieve those ends, they abandon it, or work around it, or change it, or think about changing their ends*" (Orlikowski 2000: 423).

Therefore, if this notion of agency is extended to understand technology deployment at the individual level, it can be argued that human agents will adopt and enact practices that influence the way the technology is used within a given context; and due to the recursive nature of this relationship, these adopted and enacted practices will in turn influence their perceptions of the technology. They weave a complex web of interpretation (which is influenced by previous experience, interaction with colleagues and the work environment) around the technology whilst making sense of it, it's real purpose and usefulness; and in doing so they lay the foundations of their interaction with the IS innovation that ultimately determines whether they will use it and accept its use as part of their daily routine or circumnavigate and resist its use. This notion also suggests that such a process of sense making can be lengthy, as the structures enacted by human agents are temporal in nature, that is, while some structures change quickly, others might change much more slowly (Barley 1986, Barley and Tolbert 1997, Black, Carlile and Rpenning 2004).

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[1] Habitus is defined as "the orientation of actors in a field" (Schultz and Boland 2000: 203).
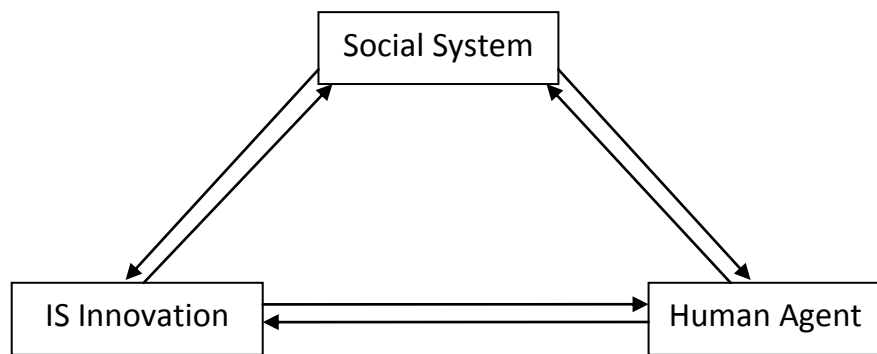
Figure 6: Triality framework (initial version)

It is noted that when studying the processes within healthcare, in addition to the broader view, understanding dynamics between the three entities is also essential due to the complexities (of healthcare context and processes) involved. Therefore, in the next section, perspectives providing insight into such dynamics are presented.

2.3 Theoretical concepts from healthcare and medical informatics literature: impact of innovation deployment and evaluation.

The perspectives discussed in this section contribute to Triality framework in number of ways. These perspectives outline the impact of introducing healthcare intervention such as telehealth and electronic records on routines and work practices of healthcare professionals over time, and also acknowledge the impact of such change on the expertise of healthcare professional, interaction during clinical encounter, and quality of care. It can be argued by drawing on these perspectives that such changes might influence healthcare professionals' decision to accept the IS innovation in daily routines.

In addition, these perspectives provide an understanding of complex processes and dynamics within healthcare systems, which can be attributed to the recursive relationship between the context of social system, the content of IS innovation and the human agent as the user. This enables the Triality framework to be updated.

2.3.1 Change in work practices and routines: the concept of Normalisation, and Routinisation

Routines are enacted because they involve guiding, accounting, referring, creation, maintenance, and modification. Individuals continuously adapt their routines with experience and by reflecting on previous outcomes, and routines rather than being stable are subjected to constant change (Feldman 2000, 2003, Edmonson, Bohmer and Pissano 2007).

Routines have four attributes that include the repetition, recognisable pattern of action, multiple participants, and interdependent actions. Taking this notion into account, individuals within an organisation can be argued to share understanding of routines and the process of its enactment, and as a result of enacting dependent and interconnected routines lead to organisational routine which encompass ostensive and performative aspect (Feldman and Rafeali 2002). The Ostensive aspect "*is the ideal or schematic form of a routine. It is the abstract, generalized idea of the routine, or the routine in principle*". Performative aspect on the other hand, is described to "*consist of specific actions, by specific people, in specific places and times. It is the routine in practice*" (Feldman and Pentland 2003: 101). As a consequence, whether a change will be accepted and routinised depends upon the "*processes of variation, selection and retention that take place between the ostensive and performative aspect*" (Feldman and Pentland 2003: 114)

Extending the concept that organisational routines are a result of mutual action that is interdependent, a hospital setting can be considered a as negotiated order, or in other words, the healthcare context can be considered as comprising "*practice(s) in which various actors are expected to be relevant partners in specific work processes*" (Tjora and Scambler 2009: 522).

A similar approach is advocated by Greenhalgh and colleagues (Greenhalgh 2008, Robert et al 2009, 2010), where they considers that routines in medical settings overlap with each other and are impacted by changes at different levels, such as changes in the wider environmental context, organisational context, and individual context.
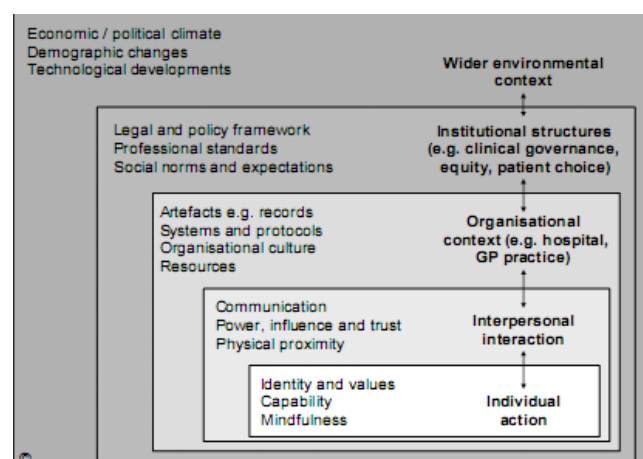
Figure 7: Routinisation of innovation: multiple levels of influence (Taken from Robert et al 2009: 94)

It is further argued that implementing an IS innovation or complex healthcare intervention such as telehealth and its evaluation strategy such as RCT, changes routine of professionals, and that it takes time for professionals to accept such changes (May and Ellis 2001, May 2006b, May 2006a). This is called normalisation, and can be understood as *"the embedding of a technique, technology or organisational change as a routine and taken-for-granted element of clinical practice"*, and is argued to consist of a set of endogenous and exogenous processes (May and Finch 2009, May et al. 2007a, Mair et al. 2007). In this context, endogenous processes refer to processes that govern the patient-professional encounter; and exogenous processes refer to organisational structure, culture and division of labour.

The concept of normalisation has now been developed into normalisation process theory (NPT) that provides *"a robust and replicable ecological framework for analysing the dynamic collective work and relationships involved in the implementation and social shaping of practice"*. The main postulate of theory is that the work in enactment of practice is governed by four generative mechanisms of human agency. These are: Coherence which is *"work that defines and organizes the objects of a practice"*, Cognitive participation which is *"work that defines and organizes the enrolment of participants in a practice"*, Collective action which is *"work that defines and organizes the enacting of a practice"*, Reflexive monitoring *"work that defines and organizes the knowledge upon which appraisal of a practice is founded"*.

Having identified how routines and work practices are interrelated, and why they are important, we now move to discussing how work practices change due to IS innovation deployment and evaluation.

2.3.2 Virtualisation and Invisibility
It is argued that deploying IS innovations such as telehealth and electronic records make medicine a virtual practice and predispose these work practices to become invisible (Mort, May and Williams 2003, Mort and Smith 2009, Sandelowski 2001).

There are different forms of invisible work, and in this research disembedding background work is considered as one such form. Disembedding background work is the work where although the individual is visible to others, the extent and severity of their work practices is rather invisible (Star and Strauss 1999, Oudshoorn 2008, Nicolini 2006). One example of such work is that of nurses.

Disembedding background work due to IS innovation deployment and evaluation originates due to virtualisation of clinical encounter, particularly in case of telehealth. This virtualisation apart from having an impact on interaction between the patient and nurse, also influences trust as telehealth involves "*faceless commitments*" that are based on trustworthiness vested in technology. Nursing practice without telehealth however, involves trustworthiness established between different individuals based on "*facework commitments*", due to physical presence of those involved. In other words, introduction of disembedding work such as virtualisation of clinical encounter calls for investing trust "*not in individuals but in abstract capacities*" (Giddens 1990, Kouroubali 2002, Nicolini 2007, Nicolini 2010, Bhattacherjee, Hikmet 2007, Berg 2003).

Disembedding work can also be perceived as threat to expertise. This stems from changes to skill set and predisposing one's experience due IS innovation deployment and evaluation. In addition, individual's resistance to disembedding work could also be enacted due to concerns pertaining to the impact of change on standards of care delivery (Nicolini 2007, Nicolini 2006, Wears and Berg 2005, Waterworth, May and Luker 1999). This notion of change having an impact on the quality of care is well documented by Donabedian in his work, and it is discussed next.

2.3.3 Structure, Process and outcome framework

According to this framework, the impact of IS innovation on quality of care can be evaluated through seven attributes (Donabedian 2003):

1. *Efficacy*

   The ability of science and technology of healthcare to bring about improvements in health when used under the most favourable circumstances

2. *Effectiveness*

   The degree to which attainable improvements in health are, in fact, attained

3. *Efficiency*

   The ability to lower the cost of care without diminishing attainable improvements in health

4. *Optimality*

   The balancing of improvements in health against the costs of such improvements

5. *Acceptance*

   Conformity to the wishes, desires, and expectations of patients and their families

6. *Legitimacy*

   Conformity to social preferences as expressed in ethical principles, values, norms, mores, laws, and regulations

7. *Equity*

   Conformity to a principle that determines what is just and fair in the distribution of health care and its benefits among members of the population

Many researchers have used this "*triad*" to explain the process of IS innovation deployment and evaluation such as electronic prescribing and administration system, in healthcare setting (Runciman 2010, Cornford, Doukidis and Forster 1994, Barber, Cornford and Klecun 2007).

In this research, this concept allows to establish a link between deployment of telehealth, RCT, and electronic records, and perception of healthcare professionals pertaining to impact on quality of care. It therefore, enables defining attributes of recursive relationship between healthcare social system and the human agent, and between the healthcare social system and IS innovation as presented in the next section.

2.4 Triality framework

By drawing on the all the theoretical concepts discussed in this chapter, the conceptual framework can now be presented in its entirety. Where according to the previous version, the Triality framework acknowledged that the IS innovation, healthcare social system, and human agent are interrelated to each other through recursive relationship, the new version identifies set of attributes attached to each of the recursive relationship. The framework further provides an understanding on how and why these attributes are articulated, and thus facilitates gaining a deeper insight into the deployment and evaluation processes.

In addition, the framework encompasses the notion that each attribute influences work routines which are described here as social practices that are enacted by interactions of individuals whose actions are interdependent with the actions of other individuals within the complex context of healthcare.
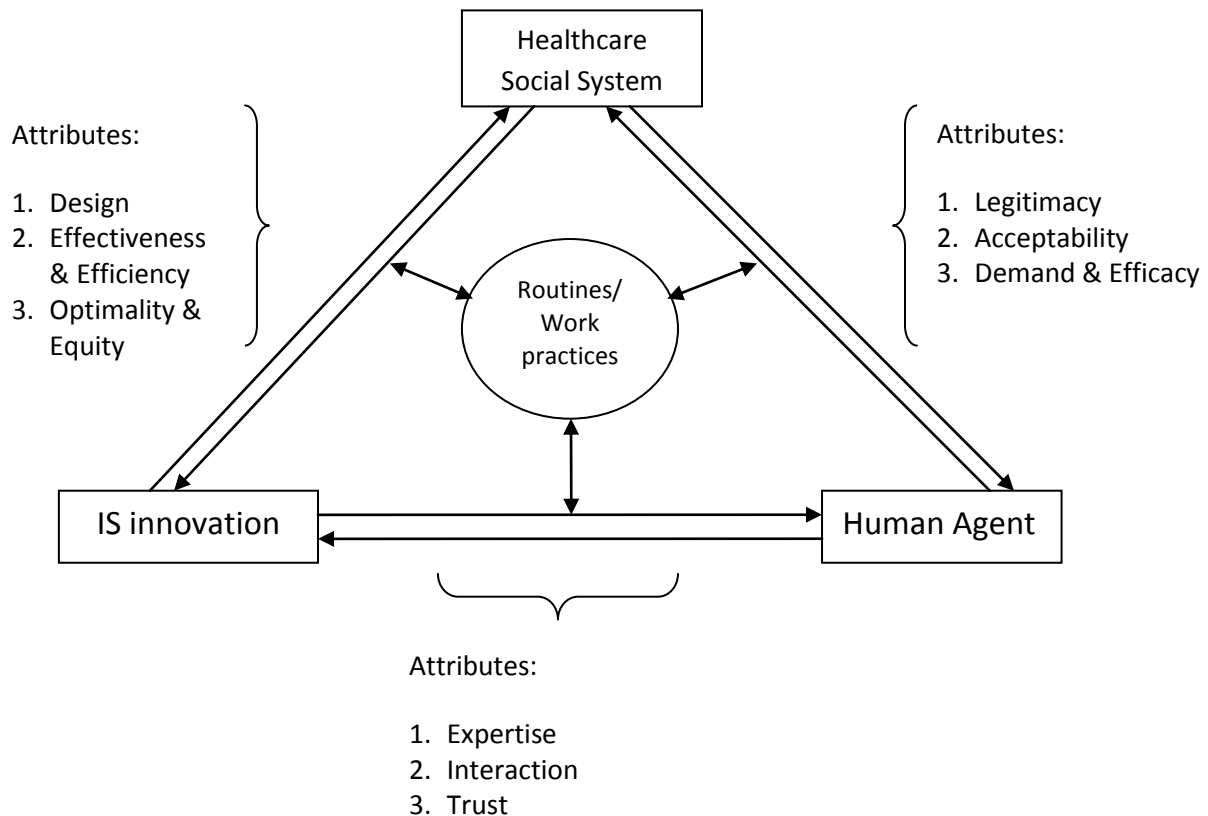
Figure 8: The Triality framework (final version)

The Triality framework has many advantages. It ensures multilevel analysis that is longitudinal in nature; responds to the calls for furthering the use of theoretical perspectives in the field of healthcare (Davidson Chiasson 2004, Cho 2007, Greenhalgh et al 2009); encompasses the 10-e's of e-health described by Eysenbach (2001), and the notion of complex healthcare intervention described by authors such as May and colleagues (2007 a, 2007b), and Campbell et al (2000) within IS innovation.

2.4.1 Attributes of relationship between IS innovation and healthcare social system

The three attributes at this level attributes are drawn from SCOT and Donabedian's work on quality of care, and illustrate how the design of IS innovation is influenced by, and influences the healthcare social system; and how the use of IS innovation is assessed on the basis of efficiency and effectiveness, and optimality and equity.

1. **Design**

   The balance of IS innovation design against the needs and requirements of the end-user, and its ability to fulfil and meet the outlined needs and requirements through its design (and design features), without being cost intensive.

Innovation design is one of biggest factors that determine whether it will be used by users and assimilated in their work practices (Orlikowski and Icano 2001, Greenhalgh et al 2009).

The tension between the design as needed and as provided is created due to many factors such as contextual issues, regulatory issues, financial margins etc; and in many cases it is the end user who decides how successful the design is, as according to Chau and Hu's (2001, 2002) study, healthcare professionals use a technology that they perceive to be designed appropriately and fit well with their work practices.

2. **Efficiency**

   *The ability of IS innovation to lower the time and allow someone to complete/carry out various different tasks thereby increasing productivity "and using time efficiently" **at individual level***

   *The ability of IS innovation to lower the cost without diminishing attainable improvements **at system level**, &*

    Effectiveness

   The degree to which attainable improvements are attained at system level and individual level (adopted from Donabedian 2003)

It is argued that healthcare professionals assess the efficiency and effectiveness by evaluating how the IS innovation might help them to deliver care and what impact it has on the patients. Often, efficiency is measured in terms of time saved during a routine task and how well it was performed.

Effectiveness on the other hand is measured in terms of quality of improvement in care delivery processes and the outcome (pertaining to patient health) (Bannister and Remenyi 2003, Mair et al. 2007a, 2007b). Effectiveness in the field of healthcare is measured by applying various evaluating methodologies to an intervention and RCT is one such method (MRC 2000). Applicability of RCT to evaluate technological intervention has been

questioned due many reasons. These include gaining ethical approval, defining selection criteria and recruiting patients, training staff and gaining their support (Rosen and Mays 1998).

3. **Optimality**

   The balancing of improvements in health against the cost of such an intervention (adopted from Donabedian 2003), &

   Equity

   The just and fair distribution of health care delivery among the patient population (adopted from Donabedian 2003).

This attribute outlines that the healthcare professionals often question service procurement decisions due to doubts over cost spend and, benefit promised and realised (McDonald et al. 2006, Mair et al. 2007a, 2007b).

In addition, it is argued that healthcare professionals favour equitable distribution of IS innovation despite the innovation being at evaluation stage as some strategies such as RCT are not promoted well enough and in doing so the managers and teams involved in evaluation fail to adequately address the need for RCT and healthcare professionals role in it (Greenhalgh and Russell 2010, Mair et al. 2007a, 2007b , Berghout and Remenyi 2005)

2.4.2 Attributes of relationship between healthcare social system and the human agent

The three attributes at this level are deduced from ST and Donabedian's work on quality of care, and they highlight the structures enacted by the human agents as users of IS innovation within the healthcare system, where, by drawing on rules and resources the agents assess the compatibility and the need of such an innovation.

4. **Legitimacy**

   Compatibility of IS innovation and its conformity to the ethical issues, laws, regulations and values.

Healthcare professionals are known to make decisions that are bound by ethical and legal issues.

In particular, ethical issues arise due to evaluation strategies such as RCT as it governs the provision and allocation of equipment to patients (Finch et al. 2003, Heaven et al. 2006, Lankshear and Mason 2001, Finch et al. 2006, Greenhalgh and Russell 2010, McDonald et al. 2006, Ammenwerth et al. 2003).

5. **Acceptability**

The degree to which IS innovation is compatible with the current job role and work routines, and conforms to the expectations of its users.

It is argued that both, the processes of IS innovation deployment and evaluation impact the work practices of healthcare professionals. This can be caused due to increased workload and redefining work roles (McDonald, Knight et al. 2006).

However, it is also suggested that such instances of increased workload and change in roles are negotiated over time and become part and parcel of routinised work practices (Greenhalgh 2009, May et al 2007).

6. **Demand**

The degree to which IS innovation is needed to improve healthcare delivery at individual level; and reduce cost at system level, &

Efficacy

The ability of IS innovation to bring about improvements in health of the patients (adopted from Donabedian 2003)

It is argued that the demand of IS innovation is mainly dominated by users experience and perception; and the sense of efficacy mainly originates from the scientific evidence provided to back up the IS innovation deployment and evaluation through strategies as RCT (McGrath et al. 2008, Clark and Goodwin 2010, Cornford, Doukidis and Forster. 1994, Hibbert et al. 2004, Finch et al. 2008).

2.4.3 Attributes of relationship between the human agent and the IS innovation
The attributes at this level are conceived from ST and theory of normalisation, and they facilitate understanding the various dynamics that contribute to the human agent's perception and the practice they enact in response IS innovation deployment and/or its evaluation, and the implications this has on the assimilation of IS innovation in work practices.

7. Expertise

Skills and knowledge required to use IS innovation in order to deliver better care to the patients (and enhance clinical encounter)

Addition of IS innovation could be regarded as an agent responsible for introducing "*expertise asymmetry*" and can cause hindrance towards its assimilation (Lehoux, Sicotte et al. 2002, Sicotte, Lehoux 2003, Greenhalgh 2009).

In healthcare, expertise can be understood to be of two types: social expertise required during social interaction with patient and colleagues, and technical expertise employed in using the IS innovation correctly.

Expertise is affected by training and support (Gagnon et al. 2003, 2006, Sallas et al. 2007). In addition, Chau and Hu (2001, 2002) found in their study, that staff support was credited for physicians' acceptance of technology; and it can be challenged due to status quo, power dynamics and autonomy.

8. Interaction

Establishing new interaction patterns and ways of communicating between various individuals at different levels

Deployment and evaluation processes pertaining to IS innovation impact the normal interaction patterns of healthcare professionals with their colleagues and patients.

Particularly, changes to interactions during clinical encounter are more evident as May (1992) argues that healthcare professionals such as nurses interact with their patients to develop 'knowing', where it refers to developing an understanding of patient not as biomedical subject but as an individual with social and personal background and needs. This requires capturing the holistic picture which entails subjective data such as how did the patient look, and the objective data such as blood pressure, weight etc. However, such 'knowing' is affected by introducing IS innovations in work practices and changing the clinical encounter.

9. Trust

Questioning the degree to which IS innovation is perceived to be reliable and safe

According to Giddens, trust serves to "*reduce or minimise the dangers to which particular type of activity are subject*", where "*danger is understood as a threat to desired outcomes*" (Giddens, 1990). A recent study by Sharma, Barnett and Clarke (2010, 2011) contributes to this topic by arguing that trust impacts clinical users' decision on using the IS innovation provided, and on a similar note, Gagnon et al (2006) argues that it affects users' readiness towards IS innovation such as telehealth.

Trust can be envisaged as technology trust, interpersonal trust and organisational trust (Li, Hess and Valacich 2008, Lippert and Davis, 2006; Lippert and Swiercz, 2005). Lippert and Davis (2006) evaluate the impact of trust on technology internalisation which refers to "*the effective and continued use of technology over time*" (Lippert & Davis, 2006; Lippert & Swiercz, 2005), and propose that greater degree of interpersonal trust and technology trust among the members of an organisation would lead to effectiveness in technology adoption and eventually achieve internalisation (Lippert & Davis, 2006).

2.4.4 What is coming next?
Having explored the literature and outlining the conceptual framework, we now move to chapter 3, where the research philosophy and strategy that the author argues to be appropriate to guide this research, is described.

Chapter 3: Research approach

3.1 Introduction

The first chapter outlines the scope of this study and the research question that is to be investigated. The literature review in the second chapter highlighted that there are two streams of literature dealing with IS innovation deployment and its evaluation in healthcare, and that each stream provides valuable conceptual lenses that facilitate understanding the topic in depth; yet both streams have developed in parallel, and there are no apparent efforts to draw on the knowledge produced within each stream. This research aims to bring together the contribution of both streams to form a harmonised conceptual framework called the Triality Framework. Having set out the conceptual framework, there is also a need to adopt an appropriate research philosophy. This chapter discusses the choice of philosophical underpinnings and research strategy chosen to guide this research..

3.1.1 Chapter outline

The chapter starts by presenting the research philosophy and the beliefs that underline the way in which inquiry will be conducted. It then outlines the appropriate research method for the research and outlines which criteria were adopted to ensure the quality of this research. This is followed by discussion of the techniques employed for collecting and analysing the data, along with reflections on ethical considerations.

3.2 Research philosophy: Recursive approach

Within IS literature, there have been traditionally three philosophical positions; the positivistic, the interpretivistic and the critical. Each differs from one another in a way that the beliefs about reality, knowledge and what is of value are structured. For example, the reality according to positivistic philosophy is treated as external and measurable. In interpretivism, reality is seen as socially constructed that cannot be measured but can be understood and expounded (Orlikowski and Baroudi 1991, Weber 2004, Walsham 2006). The critical philosophy suggests that reality is constructed historically, and that the conflict and contradiction due to power play and status quo are contained within it; and therefore, it can be evaluated by assessing social practices (Orlikowski and Baroudi 1991).

A further philosophical position termed the recursive approach in IS aims to understand issues concerning IS deployment (de Vaujany 2005, Greenhalgh et al 2009). This approach

is biased towards interpretivistic line of inquiry and, is defined as a philosophical stance that "*assumes that subject and object, micro and macro, social structure and human agency, are reciprocally related and that the purpose of research is to explore the flux between these various dualities over time*" (Greenhalgh et al. 2009:734). It is to be noted that in this definition the word "*flux*" is of great value and meaning as it represents the constant state of change and uncertainty, and reminds us that to remain stable, efforts to keep this flux in balance are needed.

This philosophy is deemed most appropriate for when problems pertaining to complex interaction in a complex context are to be investigated; with problems relating to healthcare domain being among the most complex in nature and arising in complex context (Greenhalgh et al. 2009, Cho 2007, Chiasson and Davidson 2004). Taking this argument on board and acknowledging that the appropriation of research philosophy and research methods is governed by the research question that is to be investigated (Orlikowski & Broudi 1991, Weber 2004 and Walsham 2006), it is argued that recursive approach is most suitable for this research.

The approach is expounded by considering the underlying beliefs of the philosophy (Table 8) and thereby supporting its use in this research.

Beliefs about	Explanation
Ontology (nature of the reality)	*Reality is enacted by knowledgeable agents and is recursively shaped by their actions*
Epistemology (nature of the knowledge- the truth)	*Knowledge is continuously updated through reflexive monitoring and allows the enactment of practices. These practices constitute social structures which cannot be assessed but can be elicited through agents' perception and actions.*
Methodology (what method will generate best evidence)	*As agents' interaction is what shapes their actions, and in return is recursively shaped, the*

	qualitative methods allow enunciation of practices and actions at the time, and over the period of time.
Axiology (what is of value)	*Expounding and eliciting how the IS innovation (technology-in-practice), social system (healthcare context) and human agent (user) shape and are shaped by each other in return, and what structures in the form of attributes are enacted and how disturbing the flux between dualities threatens IS deployment and its evaluation..*

Table 3: Beliefs underlying the recursive research philosophy

3.2.1 Belief about physical and social reality

The author believes that the agents enact multiple realities and are continuously engaged in monitoring their actions through self-reflexivity. Many factors such as social, historical, political and economical have an impact on this activity of continuously reflecting back on one's actions and learning from their experiences.

Additionally, the author also believes that although agents cannot always act as they wish, they will still find a way to circumnavigate the situation if they feel sufficiently strong about it. For example, to not use an IS innovation is one such act of circumnavigating.

3.2.2 Belief about knowledge

The author believes that as a researcher she was constantly updating her knowledge. This was facilitated by reading about various theoretical perspectives, and understanding the story that lie within the data. In this manner the author was continuously engaged in the process of induction and deduction, which according to Pettigrew (1997: 344) is an approach where "*deductive structuring (is only a) prelude to a more open-ended process of inductive reasoning and pattern recognition*". Thus, where some understanding about the truth was gained as a priori through theoretical perspectives that were based on personal choice (Walsham 2006), it was further enhanced by expounding the story embedded within the data.

3.2.3 Belief about theory and practice

The researcher in this study played the role of an *outside observer* who was seen as an outsider by the study participants, who had formally planned data collection procedures and was seen as neutral in sense that she had no affiliation with any specific group towards whom she might have been biased. In other words, the researcher was seen as a stranger (Lincoln and Guba 1985).

However, being an outside observer has consequences (Walsham 1995a, 1995b, 2006). Firstly, the researcher might not be present on important occasions and therefore, be unable to understand the dynamics of how the people and organisations work. Secondly, the researcher might have difficulty gaining access to the organisation. The author encountered both of these consequences and would conclude that procedures such as ethical considerations and organisational code of conduct impact what role the researcher can adhere and therefore, the extent to which the research can meet its objectives.

Conversely, being an outside observer has the advantage of having no personal interest or self-representation either in the interpretation or outcome of the research (Walsham 1995a, 1995b, 2006, Myers 2009).
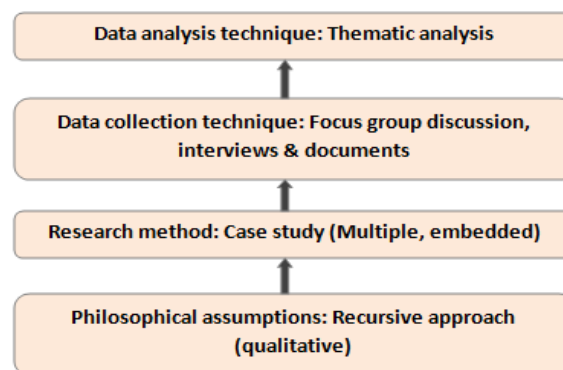
Figure 9: Research Strategy

In summary, the reasons for choosing a recursive philosophy are threefold.

Firstly, the recursive approach supported the use of existing theories creatively to conceptualise a harmonised Triality Framework that is the basis of this research. This was further enhanced by identifying and defining the three entities of the framework to be technological content (conceptualised as IS innovation), the context of the healthcare (conceptualised as a social system), and the user (conceptualised as knowledgeable agent).

The complex dynamics between the entities are conceptualised as being governed by a recursive relationship to which are attached a set of attributes.

Secondly, the beliefs underlying this philosophical position enabled the author to enact the principle of interaction between the researchers and the subjects which *"requires critical reflection on how the research materials (or "data") were socially constructed through the interaction between the researchers and participants"*, and the principle of multiple interpretations which *"requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study. Similar to multiple witness accounts even if all tell it as they saw it"* (Klein and Myers 1999: 72).

Thirdly, as the recursive approach tended towards interpretivism, the use of recursive philosophy provided a greater wealth of appropriate research methods, and data collection and analysis techniques.

The remaining of the chapter is therefore, dedicated to explain the research methods and techniques in more detail.

3.3 Research Method: Case study

In accordance with the research philosophy employed in this research, qualitative longitudinal case study was selected as research method. This matches the recursive paradigm as case studies are used to observe change over time and understand events that evolve over time (Pettigrew 1997, Fitzgerald, Ferlie and Hawkins 2003).

Qualitative research provides understanding of the meanings behind spoken words, practices enacted and actions carried out (Murphy et al. 1998: 13), and examines the complex web of meanings, feelings, beliefs and preconceptions that human agents weave (Myers 2009). In this research, qualitative research is used to determine: the perceptions of the human agent about their world; how their world evolved to its present form; what would disturb it; and therefore, facilitate understanding the mechanisms that give rise to the flux between the principle entities of this research.

3.3.1 What is a case study?

The case study "*examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups, or organisations)*" (Benbasat, Goldstein and Mead 1987: 370). In addition case study research "*uses empirical evidence from one or more organisations where an attempt is made to study the subject matter in context. Multiple sources of evidence are used, although most of the evidence comes from interviews and documents*" (Myers 2009, 76). Taken together, the essence of these two definitions provides three design characteristics of the case study research, which are:

1. A phenomenon or the 'case', which is to be studied. Outlining the case clearly is salient because it governs what kind of data is to be collected (Yin 2003)

2. A natural setting, which is the context in which the phenomenon is studied. It can be an organisation of any size or type depending on the definition of the case and its goals

3. Entities or collectivities from whom or about whom the data is to be collected

3.3.2 When is the case study a desired strategy?

The case study is ideal research method for complex "*mega-systems*" such as the healthcare, especially where boundaries are often complicated and fuzzy (Yin 1999,1981). Furthermore, such mega-systems "*can be a fertile grounds for generating theories*" (Benbasat, Goldstein and Mead 1987: 372).

Moreover, case studies have been used as a preferred method in assessing IS deployment and its assimilation within complex contexts, because of its inherent strength to consider both the contextual and temporal dimensions whilst studying the phenomenon, thereby defining and visualising a holistic view (Pettigrew 1990, 1997).

3.3.3 Nature of case study and the role of theory?

The case study also allows "*discover(y)*" during the study period, and may be considered exploratory in nature (Yin 2003). Alternatively, the case study may be used to test and explain theories and therefore can be explanatory (Walsham 1995a, 1995b, 2006). Further still the case study can be both exploratory and explanatory at the same time (Myers 2009). This research uses theory to guide data collection and analysis as use of theory in the initial stages of case study research helps build a sound theoretical background and therefore, guide

data collection, and during the research use of theory provides a "*scaffolding*" that guides data analysis and its interpretation but "*is removed once it has served its purpose*".

However, there are dangers in using a theoretical framework to guide research and data collection and therefore, in this research theories were used as a sensitising device to gain understanding of the underlying dynamics due to interaction of three principal entities (Walsham 1995, 2006, Gregor 2006). This approach also enables enact the principle of abstraction and generalization which "*Requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that describe the nature of human understanding and social action*", and the principle of dialogical reasoning which "*Requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings ("the story which the data tell") with subsequent cycles of revision*" (Klien and Myers 1999: 72).

3.3.4 Single versus multiple case study design

Generally single case is sufficient as findings ought to be able extrapolated to other settings (Orlikowski and Broudi 1991). However, multiple cases investigating the same phenomenon can help to develop a "*general explanation on synthesis across the cases*" (Yin 1981: 102). In addition, multiple case design is recommended when there are multiple units of analysis and multilevel analysis is involved. Due to the complexity of the contextual setting, IS innovation and the user in this research, it was determined to use two longitudinal case studies. In this way individual findings of each case study might be extrapolated to explore and explain the similarities and differences that might exist between attributes.

The choice of more than one unit of analysis and the choice of more than one level of analysis makes this research multiple -embedded. Although this approach is used, caution is advised to ensure that in using multiple units, some levels are not omitted and thereby considering only a partial picture (Yin 1981, 2003). To avoid this, rigorous analysis of all levels is included in both case studies within the empirical chapters where findings are reported and discussed.

3.4 Quality assurance of case research

Ensuring the validity and generalisibility of qualitative case research is a much debated topic. Many academics outside the field of IS, have argued that unlike quantitative research,

qualitative research should aim at being trustworthy. Trustworthiness can be achieved by justifying that the research carried out is credible, transferable, dependable and confirmable (Lincoln and Guba 1985, Darke, Shanks and Broadbent 1998). This research, adopts this argument and complements it with further principles outlined by Kilen & Myers (1999) proposed to evaluate interpretative case research within the filed of IS. This is done due to the analytic dimension provided by these principles and the benefit of drawing on concept that lies within the remit of IS, a field within which this research is carried out. Some of these principles have been outlined in previous sections.

3.4.1 Credibility

The criterion of internal validity can be replaced by credibility (Lincoln and Guba 1985). Credibility takes into account that there are multiple realities constructed by humans, and it does not work on the principle of isomorphism as does the criterion of validity.

Credibility requires that the researcher "*demonstrate the credibility of the findings by having them approved by the constructors of the multiple realities being studied*" (Lincoln and Guba 1985: 296). In this research, this was achieved by collecting the data from participants about their experiences on two separate occasions. Initial perceptions or constructions of realities were assessed just before the deployment efforts were initiated. At a later stage (which was almost after a year), the participants were asked to reflect back on their realities. They were asked to provide an account on how and why these realities might have changed over time.

Concomitantly, while following this approach, the principles of hermeneutic circle, which explains that the understanding of the whole is gained by exploring the "*preconceptions about the meanings of its parts and relationships*" was also being enacted (Klein, Myers 1999: 71). In addition, the author argues that herself as a researcher, and the subjects were involved in enacting the principle of interaction, which stresses on the reflexive nature of both, the subject and the researcher. The process of reflexivity draws attention to the ability of human agents on being "*interpreters and analyst*" who constantly evolve in their understandings through social interactions (Klien and Myers 1999: 74, Giddens 1984). This was achieved due to longitudinal nature of case studies.

Credibility can be enhanced in several ways, such as data collected from multiple sources and through various methods (Lincoln, Guba 1985, Murphy et al 1998, Yin 1999). This research

collected data through focus group discussions and interviews in one case study, and multiple online discussion threads in the second case study, and compared both case studies. Important was the longitudinal nature of this research which provided prolonged engagement and facilitated observing changes that took place over time. This adds to the principle of multiple interpretations.

3.4.2 Transferability

Transferability determines the applicability of research findings to other contexts or respondents. It is argued that the uniqueness of each contextual setting and the temporal nature of the changes emerging within it prevent direct transfer, however, it is possible to develop 'working hypotheses' that can be transferred to other settings with similarities. To achieve this, transferability will therefore, depend on provision of thick description of original context that includes a comprehensive social and historical account.

By following this criterion, the enactment of the principle of contextualization is also accomplished. This principle "r*equires critical reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged*" and emphasises the fact that a researcher is trying to "*understand a moving target*" (Klien and Myers 1999: 72).

3.4.3 Dependability

Dependability represents the degree to which research can be replicated in same context and with same respondents. It replaces the concept of reliability pertaining to qualitative research.

Dependability can be achieved by providing a dependability audit trail that notes the changes that the researcher observes through provision of recorded data, personal and field notes. This trail provides an account of different ways in which the change process might have impacted other processes and also been impacted (Licoln and Guba 1985).

3.4.4 Confirmability

This criterion replaces the concept of neutrality, and requires that the researcher provides an account of how the data was gathered and interpreted, in a manner that can be replicated by others and that should lead to similar conclusions (Licoln and Guba 1985). Confirmability deals with any bias in data gathered and its interpretation. It can be achieved by keeping a confirmability audit trail that details how the data was interpreted and handled.

Conforming to this criterion has the added benefit that it adheres to the principle of suspicion which *"requires sensitivity to possible "biases" and systematic "distortions" in the narratives collected from the participant"* (Klien and Myers 1999: 72).

Having discussed how trustworthiness of this research was ensured, we now move our focus to the methods of data collection employed.

3.5 Approach to data collection

The choice of data collection technique is dependent on the research topic, research philosophy and method, and most importantly on the availability of data from its intended source (Myers 2009, Darke, Shanks and Braodbent 1998). Data can be classified as either primary or secondary data. In qualitative research, primary data from original source is preferred as it adds *"richness and credibility to the qualitative script"* (Myers 2009). Therefore, this study adopted qualitative data collection methods that would identify the mental structures of the participant as change was introduced and when its outcomes were discussed. In this way contextual understanding could be developed and the changes over a period of time understood. Therefore, techniques as focus group discussions, interviews, and documents for data collection were deemed appropriate for this research, and are primary source. The following section describes each technique in detail and includes the setting where the data was collected, and the role that the researcher enacted and was perceived to enact while engaging in the data collection activity.

3.5.1 Focus Group discussion

Focus group discussion owes its origins to the field of military, and can be described as small group interview. In such interview, a particular subject is discussed in a focused manner to allow the researchers to obtain a *"self-disclosure"* from the participants. Usually participants have aspects in common and can be described as a *"homogeneos audienc*e*"* (Krueger and Casey 2000). The common aspects that these homogeneous participants share allows understanding issues around the topic discussed, by enabling the participants to enlist an array of perceptions and attitudes (Krueger, Casey 2000).

Discussion within focus group is usually started with an ice breaking activity to introduce the topic that is to be debated, and allow participants to familiarise with each other and the

facilitator. There can be more than one facilitator but generally it is considered that more facilitators may cause participants to be overwhelmed and, so restrain them from 'opening up' and discussing intimate/private issues.

A numbers of activities can follow. These establish the course of the discussion and are designed to keep the participants interested and maintain their attention. Discussion will usually last from an hour to hour and half. Pace should be natural with the facilitators ensuring that it remains within its remit and track.

Focus group discussions have several advantages. When conducted at an initial stage of research, they provide a foundation for work that is to be carried out at a later stage, identify gaps in knowledge and processes, and assess the current situation (Barbour 2007).

Focus group discussions are particularly useful to facilitate communication with participants who are "*shy*", as it can provide a supported environment for those who are reluctant to talk. FGDs also enable insight into the group dynamics and points of agreement and conflict between them (Barbour 2007).

However, FGD does have some disadvantages. It cannot be held with a large number of participants, as this presents difficulty in controlling direction of the discussion. Normally, the number of participants in one discussion should be limited to six or eight. This may result in the need to have multiple FGDs with participants and with the expectation that pattern of consensus might emerge from the discussions. A particular issue of this research was the limited availability of staff to participate in FGDs.

The setting and the role of researcher

In this research, three focus group discussions were carried out with a total of 16 professionals. These took place in a designated room in a building that was used by participants on ad-hoc basis but was not their primary work setting.

The researcher at this stage was seen as a complete stranger and her main role was perceived to be a research student who was interested in understanding what they as healthcare professionals thought about the newly introduced change in their work practice. For further detail refer to chapter 4.

3.5.2 Interviews

Interviews enable the researcher to access the perceptions of participants about their world, the way their world appears and how it become as it is today. They enable understanding of the "*insider's perspective*" by accessing the respondents' definitions and interpretation of the contextual surroundings and current situations. Interviews achieve this understanding through one-to-one interaction (Murphy et al 1998, Orlikowski and Gash 1994).

There are three types of interviews: structured, unstructured and semi-structured. Structured interviews are criticised for providing no room for participants to highlight their own views apart from answering what is asked; and unstructured interviews have the risk of not covering any relevant material. In contrast semi-structured interviews are favoured by most researchers as they have a pre-arranged agenda to ensure relevant material is covered, yet allow freedom to the participants and interviewer to explore a topic. The conduct of the interview and when conducted anonymously should be conducive to encourage the participants to reveal honest and complete opinion.

The setting and the role of researcher

In this research, semi-structured interviews were used to assess the reflexivity of agents (healthcare professionals) in action. This approach is well recognised as a method for healthcare technology assessment (HTA) and validated to provide understanding on how the introduction of new technology/service is perceived by those affected by it, their attitude towards it and from analysis understand how attitudes may be influenced (Murphy et al. 1998).

Interviews were conducted in the actual work settings of the participants. This made the context of the setting visible to the interviewees and the author, and had the added advantage that enabled the realities of day to day work affected by context to be captured. This is considered an ideal way for the qualitative researcher to understand the concept.

It is also recognised that the role of researcher at the time of interviews, which took place one year after the FGDs, had changed. She was no longer seen as a 'complete stranger' but rather as a person who was aware of what was happening with respect to the service.

The interviews were planned and conducted in the form of a play (Myers 2009). In this form, both the interviewer and the interviewee are considered characters on a stage and are

involved in acting, and endeavouring to get into the depth of characters by understanding the meaning hidden within the present situation.

3.5.3 Online discussion forums as documents

Documents are seen as historical records of actions taken and, in some cases may provide the reason why such actions were taken. Typically, documents analysis include published and unpublished reports, meeting notes and minutes, memos and papers (e.g. whitepapers). However, the recent development in media and tele-communications provides documents such as films, videotapes, and electronic records such as digital files saved on computer, emails, web pages, blogs and online discussion forums (Myers 2009). It is argued that documents are a window to understanding the culture of their authors and the context in which they are produced. In addition, documents are actors in their own right and are created by their authors and consumed by their readers, and thus evolve over time as culture evolves. This study, uses online discussion forums as documents.

Online discussion forums are described as "*computer supported communication technologies that facilitates virtual interaction on the internet*", which provide a platform for its users to exchange information for different purposes such as information sharing, coordination and emotional support (da Cunha, Orlikowski 2008: 134). Each discussion forum can contain a number of different discussion threads. Discussion threads comprise comments that participants post pertaining to a specific question or subject. Participants are normally free to participate in any of the threads at any given time.

In an online discussion forum, the spatial and temporal boundaries are extended, with the moderator keeping track of the discussion and its remit. Participants in a discussion thread have an opportunity to know each other through the details provided on personal profiles. They might have met each other during a conference or other work related occasion.

However, this platform lacks face-to-face interaction and this can be advantageous as the online discussion provides a setting which overcomes the limitations of a face-to-face interaction and allows participants to be more open and press forward with their opinions, discuss details (sometimes intimate and personal) which otherwise would not be shared, and be relaxed. Online discussion also allows including participants who otherwise would not have been reached (Adair et al. 2006, Seale et al. 2010). This includes having worldwide

experts such as from US, EU countries, India and Bangladesh etc, to comment on EMR/EHR deployment and would not otherwise have been possible for this research, both financially and time wise.

Online discussion forums have the property of capturing historic perspective due to their longitudinal nature. For example, during the course of this research the discussion lasted 13months and was still active at the time this research was concluded. They may also capture significant events, for example the discussion on Mr Barake Obama becoming the first black president in US history, and the dismay of participants over his policy on Healthcare Bill which for some had a direct impact.

In addition, the discussion allowed access to immediate subjective views as opposed to reconstructed views from interviews where participants recollect past events (Seale et al. 2010). In this manner, discussion forum captured the emotional feeling of the authors. This has advantage because recounting of feelings is tacit and ephemeral in nature, and its articulation is made easier through such a medium.

Thus, the discussions provide a unique approach to capture the perceptions and preconceptions of participants over a period of time, and how these are influenced by changes in context such as the arrival of a new government and policy changes.

Discussion forums can play a further role not just in "*design and implementation of change*" but also in "*the mobilizing of resistance to it*", and this might provide a unique insight into the cause of failures that may not be available when participants are asked to reflect on such instances in FGDs or interviews (Da Cunha and Orlikowski 2008: 136), as it is argued that participants when asked to recollect narratives of failure provide little information. They instead, attempt to exonerate themselves from the cause of failure and therefore, their narratives become biased towards protecting self-esteem (Brown and Jones 1998).

However, as with any other method of data collection, there are limitations with this method. The most important limitation is that the participants are self-selective. A further limitation is that use of computer and Internet access is required and those with no access, or unable to use computer and those with aversion to technology in general are automatically excluded from the sample of participants. Both limitations will contribute to bias and therefore should be

accounted for. In addition, there are also ethical concerns pertaining to use of data from online discussion forums and this is discussed in section 3.6.2.

Research site and the role of researcher

The discussion forum used in this research is an expert discussion forum available on LinkedIn. LinkedIn is a website that invites people who are looking for job to register and become members. Thus, the website was launched as a job seeking tool where people will upload their information and engage with companies offering positions, and contact agents. However, its role has diversified and it has become a popular platform for companies, organisations and individuals to share knowledge and information on various topics and issues. This exchange of information takes place through discussion forums, each with number of discussion threads. One of the distinguishing features of the discussion forums on LinkedIn is that the participants who engage in the discussion are experts in their field and have prior knowledge of the topic from their education or work experience.

In this approach, the researcher was also enacting the role of an outside observer as there was no participation in the discussion or influencing the participation of the individuals.

3.6 Ethical considerations

In this research the two approaches required separate considerations of ethical issues. Such was the case due to varied data collection methods employed. This section reflects on how the ethical issues pertaining to each case study were taken into account and resolved.

3.6.1 Ethical implications in regards to focus group discussions and interviews

The FGD and interviews involved healthcare professionals and therefore, ethical approval was gained from appropriate NHS committee in addition to approval from the University ethics committee.

3.6.2 Ethical dilemma using documents: online discussion forums

Using online data has recently gained interest due to the richness of information contained within it and the ease of access. However, the ethics on use of such data is currently not agreed and, consensus and guidelines are sought. One opinion is that ethical approval to use online data should be required and that the consent of those whose information is used should be gained in the same way as in interviews and FGDs. Alternatively, ethical approval might

be required but without consent, or there might simply be no ethical approval or consent required (Sarwar and Robinson 2011, Money et al. 2011, Wignia 2004).

The approach adopted in this research was that participants had knowingly and of their own volition placed opinion in the public domain. Consequently that opinion was open to whomever wished to view it and for any purpose. Therefore, no ethical approval was sought nor consent gained.

However, it is recognised that opinion of participants is being used in way not originally intended by the participants and being transferred outside of the domain in which it was originally placed. For this reason, all opinion is used anonymously and the exact nature of discussion is not expressed in order to protect the participants. Furthermore no information of personal nature is used (Eysenach and Till 2001).

3.7 Approach to data analysis

Data gathered from all three sources was analysed both manually and with qualitative data analysis software, Nvivo v.8. Thematic analysis approach was used for data analysis which "*involves searching across the data set-be that number of interviews or focus groups, or a range of texts-to find repeated patterns of meaning*" (Braun and Clarke 2006: 86). A hybrid approach of induction and deduction was adopted where coding of data was accomplished using theoretical perspectives and through identifying the story embedded within the data. This ensured that the theoretical understanding was used as a '*scaffolding*' and yet did not restrict the actual picture while analysing the data (Walsham 2006). Such an approach is subject to criticism and is believed to be unsuitable when a rich description of data is required, but is appropriate when a detailed picture of a particular concept is required. It is inevitable that research involving interpretation is unable to escape some level of conflict between the content of data collected and the theoretical concepts established to underpin the research (Darke, Shanks and Braodbent 1998).

Furthermore, by employing the hybrid approach, one is allowed to "*examine the underlying ideas, assumptions and conceptualisations-and ideologies-*" (Braun and Clarke 2006: 84) and therefore, the process promotes interpretation of the influence of sociocultural and contextual factors on individual accounts provided by participants.

In this research, the data analysis follows the iterative phases as described by Pettigrew (1997). The procedure was further enhanced by incorporating aspects of Braun and Clarke (2006), and, Fereday and Muir-Cochrane (2006).

3.7.1 The phases of data analyses

I. Developing theoretically driven initial codes
Developing initial codes provides a data management tool that (Fereday and Muir-Cochrane 2006) facilitates understanding of the data and its clustering based on the primary question that the research aims to answer. In this research the conceptual framework was used as the initial code template.

II. Familiarising with the data and developing data driven codes.
The data in this research was gathered by different methods from different sources and at different stages of the research. In each instance data was read several times to allow themes to emerge and efforts were made to ensure preconceptions did not influence. In addition, this process enabled the verification of initial codes and quality control.

This phase was iterative, with preliminary data collection, initial coding, validating the codes and elaborating the themes. This was followed by further data collection, mapping the codes and themes across cases, and identifying additional codes. Finally, the coding was used for analysis and to answer the research question.

III. Ensuring the transferability of codes
Transferability of codes was addressed in two ways. Firstly, while developing codes and defining underlying themes, feedback from an independent researcher was sought. This involved rigorous discussion followed by critical evaluation of the codes and the themes.

Secondly, initial findings were submitted as conference and journal papers to gain peer review. This was found to particularly valuable way of receiving critical feedback that improved understanding and facilitated research arguments.

IV. Connecting the codes and themes across data
This step enabled the different dynamics through which themes were occurring in each case study to be understood, thereby identifying the differences and similarities. This step *"facilitates pattern recognition across the cases in order to generate generic as well as issue-specific learning"* (Fitzgerald et al. 2003: 220).

In this research, this step enabled the difference in the significance of each attribute during the processes of IS innovation deployment and evaluation to be understood. In addition, it enabled to capture the difference in significance of attributes when the design of IS innovation changed from mature (as in case of telehealth) to highly iterative (as in case of electronic records).

3.7.2 What is coming next?

Having outlined the research approach in this chapter, the first empirical chapter considers a case study of telehealth deployment and its evaluation through RCT. The chapter investigates the perception of healthcare professionals and how their work practices are impacted by IS deployment and evaluation over time. This understanding is facilitated through the Triality Framework.

Chapter4: The case of telehealth and RCT

4.1 Introduction
In this empirical chapter, the findings of a telehealth deployment and its evaluation through RCT, in Nottingham, U.K., are reported.

The chapter aims at addressing the main research question which is "*How can the challenges that are encountered by the processes of IS innovation deployment and its evaluation in healthcare, be better understood?*", and fulfil the objective of "*evaluating the trustworthiness of the conceptual framework*".

4.1.1 Outline of the chapter
The chapter starts by briefly introducing the U.K. healthcare system. It then provides a description of Nottingham PCT's effort to deploy a large scale telehealth service and conduct an evaluation through RCT. Following from this, the findings of a longitudinal case study are reported. These are structured according to the nine attributes of the Triality framework outlined in Chapter 2. In the discussion it is argued that there is evidence that all nine attributes are important, and that their significance changes from when the IS innovation is deployed to when it is evaluated. This highlights the differential significance of the ways in which deployment and evaluation efforts are articulated and perceived by healthcare professionals.

4.2 Telehealth deployment in Nottingham and its evaluation through RCT
In England the National Healthcare Service (NHS) is a public entity that is largely funded by tax and is organised as 10 strategic healthcare authorities and consists of 152 trusts. These trusts include Primary Care Trusts (PCTs), Hospital or Acute Trusts, Ambulance Trusts, Care Trusts, and Mental Health Trusts (Roe and Liberman 2007, Rosen and Mays 1998)[2].

Among these trusts, the PCTs comprise of the General practitioner (GP) led surgeries that are the first point of contact for a patient when seeking medical help. GP surgeries thus act as a gatekeeper. The PCTs also include dentists, pharmacists and opticians. This makes the PCTs

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[2] Correct at the time of the project, however, NHS has since been restructured. In 2011, the new government unveiled plans to dissolve all the strategic healthcare authorities and trusts.

responsible for providing various services to the patients, which aim at facilitating initial diagnosis, delivering better care and treatment, prevention and raising awareness. An example of such a service includes establishing a case management programme for patients with long term conditions through a community matron based service and integrating with telehealth.

The case study discussed in this chapter, focuses on one such PCT led initiative in England's seventh largest urban area, Nottingham. It has a population of around 950,000 including that of Nottingham City and Greater Nottingham (Nottingham City Council 2011). In common with other urban areas, it has a large number of older people suffering from one or more chronic conditions that contribute to the ever expanding healthcare budget.

To contain cost and health care utilisation, the Nottingham City Primary Care Trust (PCT) with the City Council, decided to invest its under spend on buying telehealth services. The PCT proposed to increase investment and implement telehealth on a large scale alongside case management provided by community nurses, chronic heart failure (CHF) nurses and chronic obstructive pulmonary disease (COPD) nurses. The PCT also recruited community support workers to help nurses with equipment installation and data management. A full time project manager was appointed to oversee the project although during the course of the study, the manager changed to working part time.

The decision to deploy telehealth was made by the commissioners, based on results of a telehealth pilot study. The pilot project was rolled out in 2007 and involved 10 patients with CHF and COPD who were followed for three months. The initial results showed reduced hospital admission and an increase in capacity of case managers.

Plans to evaluate the service for its effectiveness were also proposed. A team from Brunel university devised a large scale randomised controlled trial. The RCT aimed to recruit 500 patients and comprised of two arms, with 250 patients in the control and 250 patients in experimental arm. The outcomes investigated included reduced healthcare resource utilisation (e.g. unplanned hospital visits, unnecessary nurse home visits) and improved physiological symptoms (e.g. high blood pressure) (Clarke 2009, Clarke, Shah and Sharma 2011). Before the trial commenced, two presentations were delivered by the research team to healthcare professionals explaining the RCT procedure and why it was taking place

However, the telehealth service roll-out suffered slow assimilation, and the RCT was

terminated after 12 months. This research focuses on understanding the issues that resulted in these outcomes.

4.3 Method

In this longitudinal case study, healthcare professionals working with patients in the telehealth initiative were invited to take part in focus group discussions at an early stage of the telehealth and RCT rollout. A year later, individual interviews were used to explore participants' perceptions of how the processes of care delivery changed over time due to the complex interaction between the deployment of telehealth and its evaluation by the RCT.
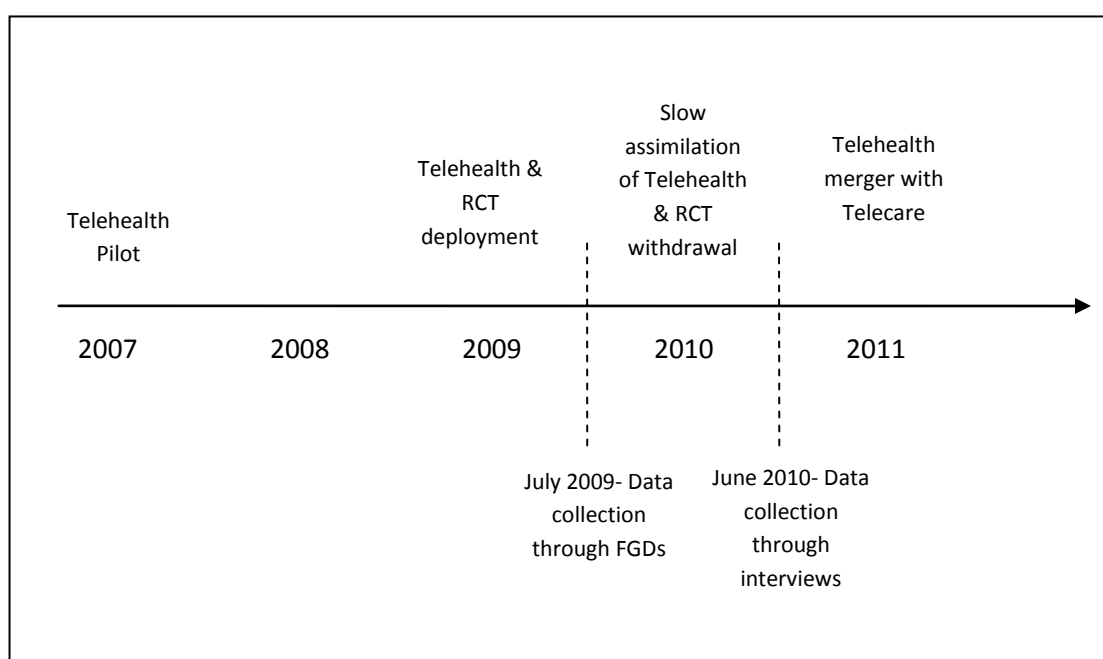
Figure 10: Data collection timeline

4.3.1 Focus Group discussions

Focus group discussions (FGD) allow the participants make sense of the issue at hand, and are an ideal tool to investigate the initial perceptions, views, and beliefs of the participants (Barbour 2007). Three FGDs were held at the beginning of the project in July 2009. In these, the main groups of clinical users who were involved with the day-to-day operation of the telehealth service were invited to participate, these included:

1. Community Matrons (CM): are registered and highly experienced nurses with a high levels of knowledge on various Long Term Conditions (LTCs). Their caseload contains patients having complex healthcare needs i.e. those who suffer from two or

more LTCs such as asthma, diabetes, COPD and CHF, and who have been admitted to hospital on multiple occasions due to symptom exacerbation.

2. Congestive Heart Failure nurses (CHF): are nurses who specialise in heart failure (HF). They are assigned to heart failure patients. Their routines include helping patients with HF to manage their condition at home and monitor their progress.

3. Chronic Obstructive Pulmonary Disease nurses (COPD): are nurses who specialise in COPD, and are part of a large COPD team- an initiative of the COPD INFORCE[3] project. They manage patients with severe COPD and monitor their progress.

4. Community Support Workers (CSWs): are staff recruited to provide technical assistance to nurses and in addition, who carry out the initial assessment of patients for their suitability to receive telehealth service.

A purposive sample of staff participating in this project was recruited. Three FGDs were conducted with representatives from at least two of the nursing groups and CSWs. The FGDs were held at Nottingham PCT(s) during July 2009 and a total of 16 staff took part. Staff experience with telehealth use ranged from 0-6 months. Each discussion lasted 40-70 minutes in duration and revolved around four main questions:

1. How did you first hear and get involved with the telehealth?

2. In what ways do you see telehealth helping your patient and yourself?

3. Do you have any apprehensions about telehealth, and if yes what are they?

4. If there was one thing that you were allowed to change about this telehealth service, what would it be?

Activities within each FGD were designed to enable better engagement of the participants and facilitate understanding of the questions asked. This included ice-breaking activity at the start of each discussion where each participant was provided with an A4 sheet of paper that had a word telehealth encircled in its centre (Figure11). The participants were then, asked to note down the words that represented their feelings, emotions or thoughts around telehealth. Once pencilled in, the participants were asked to pick one of the words and start talking about

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[3] INFORCE is short for Industry and Nottingham NHS Focus on Reducing COPD Exacerbations

it. For example, 'Technology – what happens if there is a problem' was highlighted by one participant in the sheet below.
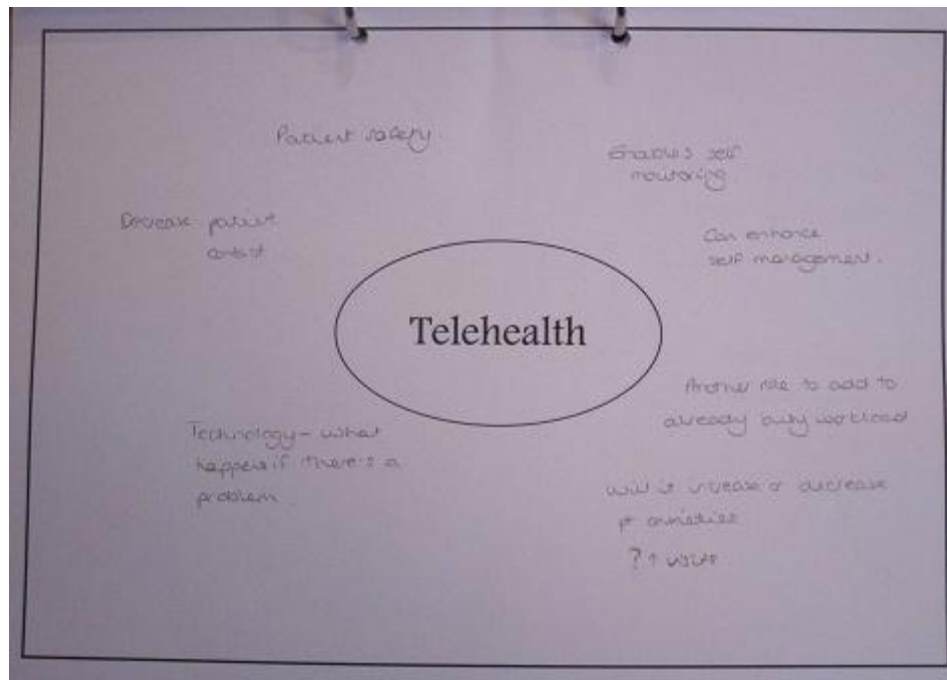
Figure 11: The ice-breaking activity sheet

Another activity included provision of two sets of different coloured post-it notes for each participant. Each participant was then asked to note down the perceived advantages and disadvantages of telehealth service on yellow and pink post it notes respectively. At the end of the discussion, each participant was asked to place their post-it notes on a chart that aimed at mapping out the advantages and disadvantages at different levels (organisational, technological, peer level) and varied severity (low, medium, high) (Figure 12 and 13). This activity provided an overall sense of the focus group discussion.

Figure 12: Wrapping-up activity chart

Figure 13: Wrapping-up chart at close-up

4.3.2 Interviews

In June 2010, a series of in-depth interviews were carried out. Four of the FGD participants also took part in the interviews. There were four new participants one of whom was the project manager who was also interviewed in order to gain insight and possible expectations of events from a management perspective.

Interviews were held at the participants' own work place in healthcare centres based in the Nottingham area in order that there was minimum disruption to the participant's daily work. Each interview lasted between 30-50 minutes.

The participants were asked two sets of questions that were briefly explained at the start of the interview. The first set of questions was designed to explore acceptance of the telehealth service, whereas the second set of questions explored issues related to its evaluation through the RCT.

4.3.3 Data analysis

All focus group discussions and interviews were audio recorded and transcribed. They were analysed both manually and using Nvivo v.8 software package. The inductive and deductive thematic analysis approach was used to analyse the data and is discussed in Chapter 3.

4.4 Results

The results below are drawn from FGDs and interviews, and are presented in accordance with the order of attributes in Triality framework. In each attribute, reflection is made on how the practices and processes of care delivery changed due to telehealth and RCT over time.

4.4.1 Design

Design is one of the attributes proposed to characterise the relationship between the IS innovation and the healthcare social system. The IS innovation in this study consists of both telehealth and the RCT. The attribute signifies the *balance of IS innovation design against the needs and requirements of the end-user, and its ability to fulfil and meet the outlined needs and requirements through its design (and design features) without being cost intensive.*

Telehealth pre- and post- deployment

In case of telehealth, the design attribute includes issues such as technical problems due to manufacturing fault, the installation of the equipment and scenarios where the equipment was used or tampered with in unintended ways.

Some nurses explained at the early stage FGDs that there were instances where a manufacturing fault had prevented the equipment from working as desired:

"one of the boxes we put was in, it was in for about six months and the voice stopped talking to him (patient). He said, I think she's has fallen out with me, because we gave him (patient) a female voice. Why would she stop talking to me any more? I have to press the buttons and read it. So that box has been changed" CHF (FGD2 2009)

Experiencing such technical issues and problems with software, staff expressed concern over expanding telehealth service:

"*At the moment we got 30-40 patients and it's a nightmare. Imagine if it was 200. So there are issues with the software and the units themselves*" CSW (FGD3 2009)

Some of these issues persisted at later stages of telehealth deployment as well, for example an instance where a nurse reflects on her experience:

"*had a patient who had three different boxes and the technical difficulties was that the pin that the plug for the BP cuff goes in, became loose several times and apparently it was a manufacturing fault*" CHF3 (Interview 8 2010)

Problems were also encountered through unintended interference by family members and other people. Examples include a son unplugging his father's telehealth device to charge his phone, and instance that included a SKY[4] engineer disrupting the telehealth device setup while installing a SKY box at the patient's home. In addition, other technological devices in home also interfered with the normal functioning of telehealth equipment, such as an answering machine that was not allowing the telehealth equipment to operate due to its message inbox being full and containing unheard voice messages.

With respect to the actual design of the equipment, staff provided suggestions for changes that would facilitate system use by wider user group, for example:

"*It would be useful to add other languages to it. Because we have got a Polish chap..with district nurses but I think they are thinking that he could go on the*

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[4] SKY box refers to digital satellite signal receiver for televisions. In the UK, it is provided by the British SKY Broadcasting.

telehealth but he would not be able to understand the foggiest word going about it"
CSW (FGD2 2009)

Further comments were made on the ergonomics of the design and some nurses argued that patients, who suffer from extreme arthritis and are dexterously challenged, require in-person help to use the equipment. An example of thermometer (added as a peripheral device to existing telehealth equipment) was provided:

"*They are quite bulky for people who might say have arthritis in the hand and they are frail and they have got to try and slide it across their foreheads and down and then put it behind their ear*" COPD (FGD3 2009)

In addition, nurses commented that asking frail and elderly patients to use the equipment was cruel:

"*I think our service very much has the more debilitated patient therefore sometimes they're not safe to have that telehealth in terms of they can't get on the scales and doing their blood pressure, the physical dexterity is difficult; they're, you know, they're arthritic so from that point of view I think it's really cruel to ask them to do that*" CHF3 (Interview8 2010)

Over the year of the telehealth service deployment and the changes that accompanied much of these issues were now being seen as a part and parcel of the service. For example, the responsibility to help frail and elderly patients to use telehealth equipment was delegated to CSWs. Staff were also better equipped to deal with scenarios of technical difficulty as the experience of healthcare professionals with installation had given them a better understanding of how technology might malfunction.

RCT pre- and post- deployment
In case of the RCT, the design attribute included issues pertaining to randomisation, selection criteria, timing of its deployment and procedure involved in administering and collecting patient questionnaires.

The nurses commented that allocating patients to the experimental arm of the RCT did not take into account the suitability of patients in regards to receiving telehealth equipment:

"*Sometimes with some patients it can make them to become more anxious. And the more anxious they become, their oxygen goes down, their blood pressure goes up and*

everything goes wrong then they will ring 999 and get themselves admitted to the hospital. I have come across that. We ended up taking it out because it (telehealth equipment) was not good for him" (FGD3 2009)

Healthcare professionals commented that the deployment of RCT should have been timed appropriately, such that it could either have been deployed earlier or later:

"*it (RCT) maybe should have been a little bit before they actually gave us the boxes in the first place because if we'd have never known about them then as clinicians we perhaps wouldn't have wanted them for clinical patients but I think because it (RCT) came in, right in the middle of saying, right, here's the boxes; you can give them to patients that you clinically feel require it, so we were doing that……and then all of a sudden they're like no, you can't do that now because they're part of this trial. We need you to just get people's consent and they'll either get it or they won't. That was probably a really bad time because people were probably using it and thinking great, you know, Mr Blog's is, you know, on it and it's made a difference*" CHF (Interview8 2010)

The timing issue pertaining to RCT deployment was also acknowledged by the project manager:

"*I think if we'd got the all units deployed and people were using them and they were out there so the commissioners were happy, you know, we've got a good system and an infrastructure in place whereby, you know, if somebody wants a telehealth unit there's a nice referral process. An engineer goes out, pops it in and everybody's… it all works smoothly. If that was all setup and then we came in and did some evaluation I think that would… that would work a lot better. I think we were just trying to do it all at the same time and it was just too much*" (Interview3 2010)

Both nurses and CSWs suggested that procedure of administering and collecting questionnaires pertaining to RCT could have been set-up differently such as having a dedicated team to recruit patients for RCT and its management:

"*it (RCT) always needs somebody from outside the organisation to really come and say: yes, we're doing this and we might as well, while we're doing it and, you know, we'll help you to get those patients*" PM (Interview3 2010)

Over the year, issues related to RCT were resolved as it had been terminated. On reflecting on the overall situation, participants were dismayed by the withdrawal but were not surprised that it had been unsuccessful. Instead, they suggested alternative strategies to RCT should have been employed:

> "*I think, you know, there's nothing wrong with a bit of qualitative, especially when you're dealing with quality of life. That's my feeling and, you know, like you say, you could speak to patients that haven't got it and talk about how it impacts their life, how often they go in and out of hospital and you can perhaps do the same for the ones that have got it so I don't think any, I don't think it should be overlooked. It's still quite, you know, it points you in a direction as to whether or not it's making a huge difference but I know that the randomised control trial didn't want that. They didn't want the patient's opinion. They wanted to know is it working clinically*" CHF (Interview8 2010)

4.4.2 Efficiency and effectiveness

Efficiency and effectiveness are the second set of attributes proposed to characterise the relationship between the IS innovation and the healthcare social system. Here efficiency signifies "*the ability of IS innovation to lower the time and allow someone to complete/carry out various different tasks thereby increasing productivity* "*and using time* efficiently" **at individual level,** and **t***he ability of IS innovation to lower the cost without diminishing attainable improvements **at system level**". Effectiveness signifies "t*he degree to which attainable improvements are attained at system level and individual level (Donabedian 2003)*"

Telehealth pre- and post- deployment

The healthcare professionals acknowledged that telehealth had an ability to increase efficiency by saving visits to patients and by providing an overall picture of their patients' health trend. In case of effectiveness, the healthcare professionals did not see direct impact, however, argued that it helped their patients to manage their own health:

> "*I think that transposes on your patient really. It's probably not how I feel about it but how they receive it. You know, it helps them. That why I am there for their care. As far I am concerned it's just a monitoring system, that's it. There is no other way I feel about it. It's a monitoring system. And as with everything else it would benefit them or it won't benefit them. So it's about the client*" CM1 (FGD1 2009)

The perceived value of telehealth as a tool that promotes self-management emerged from examples such as the following, where a nurse explained how telehealth enabled the patient to understand the reason for his deteriorating health following a night out drinking with his "*mates*":

> "*I had a chap who was going to a pub quite often and his weight would go up and we put him on telehealth and so it's kind of caught him out so it's been able to pinpoint what the problem was and he has now decided to, "oh gosh..someone can actually monitor me now and perhaps I should be adhering to the advice I've been given" and over the past 2 months his weight has been very stable and therefore it appears that its changed his lifestyle slightly. …… But it was not used for that.. I was not expecting it. But it happened and we started thinking why is his weight always 3kg more on Tuesday and the first Friday. ………. And I said to him what happening on these days. Oh I go to the pub for few pints….. It kind of helped me to kind of talk about and prompt him to his weight, his symptoms, his breathing*" CHF (FGD2 2009)

The staff argued that preventing such instances would contribute towards an overall decrease in adverse incidents resulting from lack of understanding about one's health, and over a period of time, acknowledged the positive impact of telehealth after using it:

> "*I withhold judgement until I've used it, because I couldn't see at that point how it would fit in. So, I thought if the patient needs clinical assessment, they need somebody to go and look at them. You can't assess heart failure just from checking their vital signs. But having used telehealth, I do see now where that sits*" CHF2 (Interview7 2010)

Staff commented on how telehealth as a tool enabled them to prescribe a course of action to their patients. For example, introduce a medication at the very onset of an infection, or use graphs to illustrate the health trend to other healthcare professionals as expressed by a nurse:

> "*the graphs and things are quite useful to take in to show, because I know the other two girls have done that – they'll sometimes take them to show the GP to say, you know, have a look at this trend*" CHF1 (Interview6, 2010).

In addition, despite some healthcare professionals commenting at early stages on telehealth inducing anxiety, later experiences of staff enabled to notice that in some cases, telehealth would be useful to manage anxious patients:

> "*I had a patient whose heart rate was really, really fast and, you know, it really didn't look like it was related to clinical issues. It was more anxiety-driven and he was calling an ambulance out and, you know, he was getting really, you know, chest tightness and like anyone would get when you get a panic attack: you don't breathe properly so therefore you're not getting any oxygen so it becomes a physical problem so putting the box in for him gave him the ability to look at what was going on so if he started to feel uptight, anxious, he could just put it (telehealth) on, watch what his pulse rate's doing, take some deep breaths and reassure that it wasn't a clinical issue that was causing his breathlessness; it was actually just because he was getting anxious*" CHF (Interview8 2010)

This notion was also shared at the management level where it was argued that with the passage of more time, healthcare staff will start appreciating the value of telehealth:

> "*You know, hopefully, they'll get to see that it will help organise their day because they're only going to see the patients that they need to because their red alert's non-existent. It will help prevent them operating in crisis because they're not having to go out to support somebody that has had a heart attack, but has been having breathing difficulties and things like that, that can actually organise themselves better. And, actually, where somebody's health is going to decline, they can actually be ahead of the game, if you like, and actually help support that person through that decline, rather than, again, it's in crisis, they're in hospital, what have you*" Telecare lead (Interview4 2010)

RCT pre- and post- deployment

RCT was argued to decrease healthcare professionals' efficiency due to added workload of patient assessment and recruitment. In case of effectiveness, although healthcare professionals understood its rigorousness, RCT was not perceived as a suitable strategy for telehealth evaluation.

Nurses argued that RCT increased their workload because of going through selection criteria to assess patients' suitability, gaining initial consent from the patient, and filling-in the questionnaires:

> "*We were already busy so there were concerns about workload pressures….we do have patients who will need help filling in the questionnaires..so there is going to be workload implications*"CM2 (FGD3 2009)

The nurses also expressed that efficiency was compromised due to lack of support pertaining to research project:

> "*I think the problem is usually when we have research, coming from my experience of research, is that we have a research nurse who actually knew about the research, who knew that you had to do observation more often, but that was all what you got involved in. You did not feel that pressure of workload, but here there is more. Although you have original recruits that who are the people going to be we are actually having to go out there and speak to them about it filling in initial questionnaires and things. That is more workload. I have to say that I have seen..I call them the brown envelopes..the amount of them. So I can see why people are feeling a bit pressured*" CM (FGD1 2009)

Even a year later, such views were still prevalent among healthcare professionals and some argued that not having enough support resulted in RCT failing to assess the true impact of telehealth:

> "*I think you need to have a dedicated team to conduct it because it stands to be quite descriptive and informative and I think if you don't get the consent or the uptake then you're going to struggle because your numbers are going to be low and, you know, it's not going to work and it's not going to prove anything statistically significant*" CHF (Interview8 2010)

At later stages, taking into account the feedback from healthcare professionals over a period of time, the project manager commented that in addition to providing administration and technical support, different evaluation strategies should also be considered:

> "*building evaluation, not maybe an RCT, but have some really robust local evaluation that you can use because commissioners need to know that it's working and need to know that it's beneficial*" (Interview3 2010)

Thus pertaining to RCT, although the healthcare professionals perceived the value of research and appreciated that it must be carried out to assess the effectiveness of interventions such as

telehealth, they argued that in case where technology evaluation is involved with complex long term conditions, different methods should be employed.

4.4.3 Optimality and equity

Optimality and equity are the attributes proposed to characterise the relationship between the IS innovation and the healthcare social system. Here, optimality is defined as "*The balancing of improvements in health against the cost of such an intervention (adopted from Donabedian 2003)*", and equity is defined as "*The just and fair distribution of health care delivery among the patient population*".

Telehealth pre and post-deployment.

The healthcare professionals commented that in case of telehealth, optimality was compromised by two factors. The first factor included instances where peripheral devices that could be attached to telehealth machine were not available because of their cost:

> "*Thermometers are not fitted as standard. we know we can get them but they are expensive. About £500 each. yes. SO obviously temperature is clinical sign for infection, it's not something we use a lot just because the cost of it. but those patients who are sensible we ask them to put them .most patients use thermometer regularly anyway*" COPD (FGD3 2009)

The second factor was the RCT which was perceived to have interrupted allocation of telehealth equipment:

> "*the commissioners quite rightly are thinking, well, what's holding us back giving out these Telehealth monitors to patients and perhaps they were getting a lot of feedback from clinicians saying I want my patient to have telehealth but I know he can't now because it's being restricted because they're in a trial and therefore it's randomised to certain people*" CHF (Interview8 2010)

In hindsight, this point was also acknowledged by the project manager who stated that:

> "*I would say don't go out and buy loads and loads of units in one go. ..what we're trying to get to now is a, sort of, mixed economy whereby we've got different technology for different patient groups for our levels one, two and three. In the*

KAISER[5] triangle, ...we know that the technology we've got is really only effective at the very top bit of the triangle. It's the, kind of, all singing, all dancing technology, whereas actually there's cheaper, simpler technology that will help manage conditions that are, kind of, ...single conditions or further down the KAISER triangle. So, ...I would say...think about lots of different technology and not just, kind of, putting all your eggs in one basket with one supplier" (Interview3 2010)

In regards to equity, some nurses argued that telehealth service risked alienating potential patients due to patient training and supplementary training material provided:

" at the end of the day they (patients) don't have a formal training on telehealth. ......all you're given is written kind of consent and obviously a little booklet explaining it. That can quite quickly kind of discriminate against patients that aren't great at probably comprehending or reading. It was in small font so issues with vision so perhaps, ... it wasn't the best way to just do it directly just like that" CHF (Interview8 2010)

RCT pre- and post- deployment

In case of RCT, the notion of optimality was a cause of concern to commissioners whereas the debate that surrounded equity was related to healthcare professionals and their views about it.

The project manager described how commissioners were split between decision to roll-out telehealth and justify its cost-effectiveness through RCT evaluation, and its impact on providers of the service such as managers:

"the changing landscape in the NHS....meant that the commissioners and the providers were splitting. ... over the last few years we've developed this much more performance-managed culture now, so commissioners are very heavily performance-managing us as the providers and if we're not performing and if we're not delivering; we're actually in a very difficult position then because we can, potentially, lose contracts. So, if commissioners are saying: why haven't you got those 300 units out there, you know, that's quite... it's not like the old days where we were all one big

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[5] KAISER triangle is an approach taken by healthcare organisation-Kaiser Permanente to design optimal care delivery for patients with chronic conditions according to the prevalence of conditions, the severity of symptoms associated with the condition and support needed (DoH 2005).

happy family and it didn't really matter. They're now coming down quite hard on providers if they're not delivering and we were in that position because we weren't getting the units out there" Telehealth project manager (Interview3, 2010)

Healthcare professionals argued that RCT introduced issues pertaining to equity at two different levels. On one hand, staff expressed apprehension towards the randomisation of the patient's inclusion in the RCT as their preoccupations around maximising appropriate care for the patient sometimes conflicted with the aims and objectives of the RCT. According to clinical users, although robust clinical research is desired, a strategy that allowed them to handpick the patients would have enabled fair access and avoided anxious patients from getting telemonitoring equipment which in some instances caused more harm to the patient than good:

> "*It is about how you assess the patient. It is the thing. It is good doing what we are doing. Research is a good thing, because it's worth waiting. You choose the right patient for that. I mean I have got a lady who's really hypertensive who I would really really look to put on it, but it actually sends her stir crazy because she would not know how to cope with it……It is about assessment and putting the correct people up*" CM (FGD1 2009)

In addition, the staff argued that people from ethnic minorities were not able to take part in the trial due to its selection criteria[6], despite the fact that large part of population is comprised of people from ethnic minorities and have a high prevalence of the disease:

> "*That's what the exclusion criteria of the trial is. Which in something like Nottingham, extremely diverse it's excluding awful lot of patients from the trial*?"

And another nurse adds:

> "*Yes, definitely, got a big Asian population as well haven't we? And Chinese and all sorts*" Both CHF nurses, (FGD2 2009)

It was noticed that this attribute was initially articulated with respect to both telehealth and the RCT. Over time, most of the issues pertaining to RCT were resolved as the RCT was withdrawn and staff were more at ease with the telehealth equipment.

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[6] In this RCT, the selection criteria included the patient be able to understand English in order to use the device. In addition, it also required the patient to have an active phone connection, and be in reasonable health (despite suffering from CHF and/or COPD) such that he/she is expected to live more than 2 years.

4.4.4 Legitimacy

Legitimacy is one of the attributes proposed to characterise the relationship between the healthcare social system and the human agent. In this research, legitimacy is defined as *"Compatibility of IS innovation and its conformity to the ethical issues, laws, regulations and values"*, and therefore, is argued to be experienced through laws and regulations, and through ethical implications.

Telehealth pre- and post- deployment

In case telehealth, no formal rules and laws applied to the deployment of telehealth. However, one aspect which dominated users' attitudes was the ethical implications of possibly denying a treatment to patients due to the evaluation strategy used and the timing of commencing the evaluation.

RCT pre- and post- deployment

The healthcare professionals were of the opinion that the process of randomisation inherent in the RCT method might allocate the equipment to patients who are anxious by nature and the anxiety caused by having the equipment might contribute to their health deterioration, while on the other hand it denied equipment allocation to the patients that might benefit from it.

> *"There's an ethical bit to that as well, definitely, which I think came up at the beginning when we were talking to some of the teams about withholding something that is potentially beneficial to a patient, but not being able to give it them. And I think clinicians found that very difficult, even though you can argue the case that nobody's proved that this is beneficial, they saw it as beneficial, they wanted their patients to have it and they couldn't really use it"* Telehealth project manager (Interview3, 2010)

There were several other issues that contributed to this belief. For example, staff argued that they were uneasy about getting the patient's consent to take part in the trial when they believed it would be unfavourable towards patient's emotional and mental wellbeing:

> *"I don't understand why everybody has been consented. Because I feel there is a psychological element there…..I think that does affect them."* CM (FGD1 2009)

Furthermore, staff said that at times it seemed odd to go through the procedure of recruiting a patient due to the patients' perception towards research

"The moment I said oh.. this is study and I started to explain and you could just see him switch off immediately. So some people are put off a little bit by the word research. Because they think we are testing something out on them" CHF (FGD2 2009)

One reason provided by clinical staff for prevalence of such an attitude among patients was prior engagement of elderly patients with other services and thus being overwhelmed by the burden that it exerted:

"Because they're having a lot of involvement with lots of agencies already, you know, intermediate care, carers, social services, us, district nurses, it was just another thing that I think was a burden. So they weren't… they found it a burden" CM (Interview5, 2010)

It was also highlighted that the RCT rollout created two additional conflicts. On one hand it disrupted the original roll-out plan of telehealth service and also involved ethical dilemma:

"the clinicians were engaging the telehealth and they wanted to install it, but they weren't free to do that, because we had to make sure the patient was in the trial. And then we had to check if they were equipment or no equipment and if they were no equipment, and the clinician thought they'd benefit from it, they found that a real problem" Telehealth project manager (Interview3, 2010)

On the other hand, the decision to roll-out the telehealth service and evaluate it with an RCT overwhelmed the clinical users by expecting them to simultaneously familiarise and get used to the telehealth service procedures and its evaluation:

"it would have been better if telehealth had been embedded in more and more units out there, to then have introduced the RCT as an additional evaluation tool on an established process and protocol. And…therefore, it'd be more successful because clinicians were then used to the fact they're using telehealth, used to talk to the patients about what it means" Telecare lead (Interview4, 2010)

Some nurses expressed concern that the telehealth service might be withdrawn from the patients once the trial was over. They argued that it was not "*right*" to recall the equipment once the patient has started to rely and depend on it.

Many of these concerns were not evident a year later when the RCT had been terminated. Staff were relaxed in the way they described the process of assessing and evaluating their patients in order to receive telehealth service. They seemed more confident and in control in taking decisions pertaining to telehealth allocation which calls upon their experience and intuition, both of which had arguably to some extent been undermined by the RCT.

> *"We know the patients who are capable of using telehealth and the ones who aren't going to be.. and 99 out of 100 we seem to be getting it right at the moment"* CSW (Interview2 2010)

As this attribute of telehealth was mainly articulated due to the RCT, its termination resolved many of these issues.

4.4.5 Acceptability

Acceptability is one of the attributes proposed to characterise the relationship between the healthcare social system and the human agent. Acceptability is primarily affected by change in daily routines. The daily work routine of the nurses consisted of a range of complex processes and practices. The key theme emerging from the focus groups and individual interviews with respect to this attribute was that the telehealth service increased the nurses' workload, and that this new added work had to be accommodated within their existing daily work routine. Some of the issues that were identified were linked to the implementation of the telehealth, while others were linked to the evaluation of telehealth service. The increased workload was also perceived to potentially compromise patient care and safety.

Telehealth pre- and post deployment

Equipment installation and the computer system

Installation of telehealth equipment at the patients' home was perceived by nurses as an unacceptable imposition on their existing workloads, and was not considered to be a part of their job role.

In addition, the nurses explained how an unnecessary workload arose from the need to provide patient information to both, the existing clinical computer system (System1) and the telehealth system. In the following quote, the nurse explains how this would impact their time:

> "*that is very very time consuming, when you are having to actually document something twice. You are doing on telehealth and having to transfer it to System1*" CM (FGD1 2009)

However, after a year, the responsibility of installing the equipment was delegated to engineers, allowing the nurses much needed freedom. In addition, the nurses felt that although the telehealth increased workload and affected work practices, there were positive outcomes, such as expressed by a COPD nurse, that the increase in workload has been in a:

> "*good way, because if somebody is unwell, you know, traditionally a patient may well sit there at home, feeling unwell. But they would not necessarily call us. They would leave it a few days until they get worse, and then call us. However, with the monitoring, we're able to, because their oxygen level is low on that day, we would call them. So it may have increased the workload, but in a good way, because it might mean that we visit them earlier and, but we're, you know, we're in the business of preventing admissions to hospital. So the workload is a correct way of our time, it's the correct use, that's fine, absolutely fine*" COPD (Interview1 2010).

For resolving minor technical issues, CSWs were summoned and it seemed that CSWs were comfortable with such a role and distributed responsibility.

However, the situation with data entry (use of two systems) did not change and it might continue to be the same for a long time as (while interviewing the manager) it was noted this was an issue of ongoing debate for almost 4 years and with lack funding in the current climate, progress here seemed even less viable.

Nurses role in CSW and patient training
The nurses also described the burden they had experienced as they had had to provide the initial informal training to the CSWs on all the procedures related to telehealth which included checking and reporting on the daily patient measurement data.

This was in addition to CSWs expressing their own concerns regarding their redefined role which they found confusing. Some commented that FGDs helped them clarify their understanding while the others expressed surprise at being involved in the equipment installation process:

> "*It's not what I thought I took the job for. I thought it was personalised, clinical computer (some use and not installation) and documenting*" CSW (FGD2 2009)

The nurses were also responsible for training patients on their use of the telehealth equipment. This training was described as an "*ongoing*" process, as patients often neglected or forgot the advice given by the clinical users more often than desired

With time however, the CSWs reported that after a year their role in the telehealth service had become more clearly defined, and that they had gained more confidence and established a good reputation. Nurses agreed with this and argued that what had originally been perceived as a cause of disruption to routine had now become a valuable resource.

> "*We couldn't do telehealth without her, to be honest……She's taken it on. She's very competent anyway, but she's taken it on to check the results every day, and then just lets us know of any alerts. And it's really noticeable when she's off. It's something that we don't have to think about to go and do, because it's not in our normal routine*" CHF1 (Interview7 2010)

In regards to the patient training, the nurses and CSWs were still the prime clinicians who had to train the patients, and, when asked if they would prefer an engineer to deliver the initial training on use of telehealth equipment, nurses and CSWs insisted on retaining this responsibility as one CSW explains:

> "*I think it's easier to explain something to somebody when you've got some sort of relationship with them, whereas an engineer comes in who hasn't got the relationship, could be over-technical because I know engineers who are very over-technical and leave them more confused than when they walked through the door, whereas we know the patients, we know who'd need in-depth information and we know the ones that need to keep it simple and, you know, we can give them the information they want*" CSW (Interview2 2010)

RCT pre and post deployment

Early assessment

Nurses clearly perceived the initial assessment of patients for the telehealth evaluation as an addition to their already heavy workload. They had to change their working routines in order to accommodate these tasks, and some would work through their lunch break.

The nurses also reported that the details of patients being assigned to them were inaccurate or incomplete. They described how some patients being assigned had died, were in hospital or allocated to another nurse. They reported that data provided to them was out of date, and it became their responsibility to check and take appropriate actions, which clearly added even further to their workload.

Some nurses were also concerned about distribution of patients in their caseload:

> "*Obviously because the patient have been picked up randomly so one matron might have ten patients in the caseload who have been chosen in the trial and then there is another matron who might have two. I think there is lot of ..of grumbling about that as well*" CHF nurse (FGD1 2009)

After a year, nurses had no complaints about assessing their patients as the trial had been withdrawn. Instead, they now had the freedom to assess those patients that they thought would benefit from the service and recommend them as suitable candidates. In addition, much burden had been removed, especially related to the paper work such as administrating questionnaires for the RCT.

4.4.6 Demand and efficacy
Demand and efficacy is another attribute that is proposed to characterise the relationship between the healthcare social system and the human agent. In this research, demand is defined as "*the degree to which IS innovation is needed to improve healthcare delivery at individual level; and reduce cost at system level.*", and efficacy is defined as "*the ability of IS innovation to bring about improvements in health of the patients (adopted from Donabedian 2003)*".

Telehealth pre and post deployment
This attribute investigates how the demand of telehealth was impacted by the perception of healthcare professionals which in turn was influenced by the reactions of patients, scientific evidence and their own experiences with telehealth. The attribute also highlights the role that an equipment supplier can play in influencing the perceived need of telehealth.

During the initial focus group discussion, the nurses reported that their patients did not understand the need for the telehealth service. This is expressed by one nurse when she recounted the reaction of an elderly patient:

"He said well you been coming to see me for two years, I know there is a telephone and I could pick it up and call you. How many times have I had to do that in last two years?" CHF (FGD2 2009)

In addition, the nurses commented that they perceive little need for the service based on the geography as the distances involved were not an issue in an area such as Nottingham.

The healthcare professionals also expressed the need for evidence pertaining to intervention to be conveyed to them. They argued that management had made little effort to keep them informed of similar efforts elsewhere in the country nor provided evidence of the benefits, which they believed had an adverse impact on their perceptions. As reported by one nurse:

"When we were introduced to it, it was more a case of: the units have been bought – we've bought a lot; I think it was 300 – and we need to use them. So, use them. They're there, so we've got to get our money's worth. And I don't think that sparks the clinician's interest very well, you're talking about that to a nurse who, is just as much aware of cost-effectiveness as the managers. So, to say, just use them, without evidence, that's going against my code of conduct, my clinical governance. It brings up lots of issues to me. But if [name of the person] have approached and said, we've got this trial that's been done in [name of the place], and they're using it really regularly there, and they've saved X amount of bed days, and the patients have found it really good. They autonomously feel confident in their condition. That would have sparked my interest" CHF2 (Interview8 2010)

Later, she reflected on how other healthcare professionals had reacted to the decision of telehealth deployment without being supported by the evidence:

"that was brought up to one of our local consultants, …….. he said, well, until you show me that type of evidence for the telehealth, I don't want to contend with it, because I know that a heart failure nurse is cost-effective via this randomised control trial done locally, done in this country, and has got the results. Until you show me that, I can't even think about telehealth until I know how evidence-based it is. And that's how clinicians work. It's all about evidence and it's all about proving it" CHF2 (Interview8 2010)

Concerns regarding sharing the experiences in the telehealth project were also articulated in an interview with the telecare[7] lead (who now is looking into merging the telehealth and telecare service after being successful in rolling out the telecare service):

> "*I don't think enough stories have been told or enough stories have come out of the existing deployment of telehealth, to be able to give the messages across the board.....Well, we haven't got that kind of spread across the matron teams, the nursing teams, that says we all know how good it is, we all know the stories because we've had the information passed back to us that telehealth has prevented admissions, has cut down on visits, has helped organise workload…. I think that telling the story is part of a way of gaining acceptance amongst clinicians. And once the clinicians have got it, they're much easier able to convince the patient to have it*" (Interview4, 2010)

There was a perception that the equipment supplier had not provided sufficient support and this impacted how the service delivery had been established. The manager explained the supplier should aim to build a better relationship by providing more practical ways of getting equipment, for example:

> "*There were different ways that we could have got those units. We could have done a lease – that model – or something that meant we didn't have such a huge capital outlay and then have assets just sitting doing nothing. And, so I think the way they sold it to us in the first place was, you know, they took advantage there. And then consequently, or subsequently, they went on to no longer sell the model that we'd bought. So, therefore, once again we were, kind of, left a bit high and dry because they weren't really interested in supporting us anymore, because they weren't pushing that thing*" Telehealth project manager (Interview3, 2010)

RCT pre and post deployment
Health care professionals did not perceive the need for RCT to evaluate the effectiveness of telehealth, as users who were accustomed to telehealth could see some of its benefits:

> "*we were a bit alarmed when one of your colleagues one of professor from Brunel came to our meeting because it had seemed that it was already effective*" CM (FGD3 2009).

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[7] Telecare involves installing sensors at patients home to **prevent** adverse incidents such as fall, carbon monoxide (Co) poisoning, fire, and flood etc.

Such perceptions on the lack of a need for the RCT persisted over time and some nurses argued that if the cost-effectiveness of telehealth was to be evaluated then alternative data collection methods should be employed and this should aim at seeking user opinion prior to launch of the intervention:

> "*There has to be a meeting of mutual agreement, and say, we know that Telehealth has worked in this area, would you be prepared to try it out? Okay, let's talk about it. Let's get engaged in this. How else will it work? What's going to happen for the patient? Who can have it? …………. if they (commissioners and providers of the service) could engage with us, and then take that information and sit it with themselves in the cost-effectiveness box, then perhaps they'd get more qualitative data*" CHF (Interview8 2010)

4.4.7 Expertise

Expertise is one of the attributes proposed to characterise the relationship between the IS innovation and the human agent. Expertise in this research is defined as "*Skills and knowledge required to use IS innovation in order to deliver better care to the patients (and enhance clinical encounter)*".

Telehealth pre and post deployment

Clinical users expressed opinion that their expertise pertaining to use of telehealth was being undermined due to inadequate training and support provisions around installation and calibration of equipment.

Training

The healthcare professionals reported that they had found the training to be too technical, incomplete and given too far in advance, and there had been no follow-up. In one case, the training had been cut-short due to a computer problem:

> "*the computer had gone down so we did not actually have any training on how to access the site. So we muddled through with it for a bit*" CM (FGD1 2009)

The healthcare professionals further described how they would have preferred the training sessions to be delivered in actual work settings and based on real scenarios. Nurses stated that if the telehealth is tended to measure physiological parameters of a patient then a volunteer should be used during the training session rather than a plastic dummy. They explained that

the use of plastic dummy might mask many of the real life scenarios where taking readings could become challenging.

They also explained how they would have appreciated further training opportunities and to have worked in smaller groups. This was acknowledged by the telehealth project manager:

> "*In hindsight we would not have done… trained so many staff all at once, because we then didn't have… because people got the training, we, sort of, did large numbers very early on. Bang, bang, bang, got everybody trained up, but they didn't all go out and start using it straightaway. So, by the time they came to use it, they'd lost the skills and we had to train them again*" (Inteview3 2010)

In response to these concerns, a dedicated and experienced trainer has been employed and is always contactable. In addition, nurses from another site have been invited to describe their experiences.

Support (CSW, Engineer & Point of contact)
The intent was to have sufficient community support workers to provide assistance to all the nurses. However, the delay in recruitment and their training meant that not all the nurses had assistance and this caused delays in assessing patient observations:

> "*There are times when I can't physically check. I mean I (have) got 2 people on it (telehealth) at the moment but there are days when I can't get (access to the observations on the computer) because I am pulled out the door for visits, So that's not how it should work and I know that but its only me and have not got anybody at the moment who can look at the (observations)*" CM (FGD3 2009)

The nurses also expressed concern about the level of technical expertise that might be required from them:

> "*I am not technological. I am not familiar with the setup of it. I am happy to check clinical parameters and assess the patient but the technical side of it is not just my bag really and I would not feel confident to say that yes I have set this up and it's working and its safe..and nothing wrong is gonna happen*" CM (FGD1 2009)

The nurses also expressed some concern with the practicality of equipment installation, especially with respect to the problem of setting the equipment in the patients' homes:

> "*if the monitoring equipment is in one room and the phone line is in another room then there are leads everywhere*" CHF (FGD3 2009)

The CSWs had issues with engineering support and IT support. They argued that engineers from providers of equipment did not respond on time:

> "*We can go in and we can change the connectors, we can change the wires cables we can go through the Genisis machine and I can reset all the passwords and pins if somebody is played about with it. But ones you have done all that and reaches a point where its gone past you know what I know I can fix and I need an engineer, just don't seem to get one..... I think there have been more sightings of the Yeti then of the engineer*" CSW (FGD2 2009)

In regards to support from IT staff within the PCT, CSWs commented that they lacked understanding on telehealth issues, and often the healthcare professionals resorted to seeking help and advice from each other:

> "*the ordinary IT people have not got a clue what we are talking about when we mention telehealth and after the first lot being rolled out over two years ago you know that is pretty poor*"(FGD3 2009)

The nurses also noted that there was no single point of contact, resulting in frustration and delays in resolving the issues that arose due to telehealth and the RCT.

With time, these issues were being resolved and formal support arrangements were being put in place. This included having a qualified engineer for equipment installation in the patient home and its maintenance, a dedicated person to provide training and support and act as a single point of contact, and a full time telehealth project manager was put in place. These initiatives were welcomed by the healthcare professionals who wondered why such efforts had not been made a long time ago:

> "*We had a meeting last week to introduce us to the girl who's going to be running it, and we were told that there were two engineers that were going to do a day each devoted to telehealth. So, it's only just happening now. So, until now we haven't had that support. It's been very difficult getting engineers in and things*" CHF1 (interview7 2010)

RCT pre and post deployment

In relation to RCT, healthcare professionals argued that their expertise was challenged due to inadequate support. This included support for patient assessment and recruitment for the trial. The project manager also acknowledged this point as she commented that getting patient consent and completing questionnaires was not a priority for healthcare professionals as they aimed at delivering clinical care and tending to patients' clinical needs was their priority:

> "*Had we had somebody…. who came out and kept saying right, come on, let's go and get some more patients; it had been somebody constantly there to, kind of, drive it and push it then that might have helped a bit more. Because it… I was… I found it difficult to do that because I think I was very aware operationally of the pressure they were under. And I could totally see that this was not a priority for them. So, it became very difficult for me to say to them: no, you need to do this, because actually I could see that this was not a priority and I know in the scheme of things it isn't a priority*" (Interview3 2010)

4.4.8 Interaction

New patterns of interaction is another attribute proposed to characterise the relationship between the IS innovation and the human agent. Interaction in this research is defined as "*Establishing new interaction patterns and ways of communicating between various individuals at different levels*"

Telehealth pre and post deployment

The nurses considered telehealth only as a 'monitoring tool' and perceived telemonitoring[8] technology not to be as effective as human presence. They expressed concerns over how using this 'tool' might affect diagnosing underlying health problems and contribute to social exclusion.

Users were initially apprehensive about the decreased face-to-face interaction with patients that might result from using the telehealth service and how this could impact on diagnosing problems:

> "*I think the sort of thing one wonders with is lack of the face-to-face contact. And although you are asking questions and doing specific…you know…sign and symptoms*

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[8] Used synonymously with telehealth

there is always a chance that there could be something that you are only going to see if you are face-to-face with somebody" CHF nurse (FGD1 2009)

They commented how subjective information from a patient's look might be used to diagnose underlying conditions such as depression and infection.

Some nurses argued that telehealth could contribute to the social exclusion of patients:

"*if you get them to the clinic or a group session or we were visiting, we could identify social isolation. And perhaps day centres, things like that. So it can mask I think social isolation. This patient was crying out that I just wanted the human touch back He was stir crazy and he could not get out of the house and felt he was confined to the house. Just talk about things and not a box because it's not a person, is it?*" CHF nurse (FGD2 2009)

The opinion pertaining to the need for face-to-face contact continued over a year, but there was a change in the way telehealth was perceived. Users described telehealth as a "monitoring tool" that allowed them to be more reactive to exacerbation events, have more information and enjoyed improved communication with their patients. They were more aware of where the intervention was useful and where the equipment had its limitations:

"*lot of patients with cardiac disease have arrhythmia so their heart rate's very irregular and we know that some of the actual equipment doesn't pick up an accurate heart rate so it's always good to check yourself and, you know, be able to be comfortable with that and it doesn't pick up irregular heart rhythms. It wouldn't tell you that suddenly that patient's gone from a regular heart rhythm to an irregular and it's very common in heart failure for someone to be suddenly having a normal heart rate and then them to go into arrhythmia which could be quite life threatening so I think from that point of view I would still need to physically assess my patients*" CHF2 (Interview8 2010)

Furthermore, it was pointed out that the telehealth deployment had increased communication between the CSWs and the nurse, and this had facilitated peer learning:

"*I've had more contact with some of the nurses from other areas; like you say from COPD and heart nurses because I'm actually monitoring some patients who come under the heart nurses*" and "*learn from it, yes, and you get contacts and it's easier to*

talk to somebody if you actually know them, you know.   If you want to discuss a patient or something with them it's easier if you've actually had some contact with them before" (Interview2, 2010)

RCT pre and post deployment

Nurses argued that RCT consenting and going through the initial assessment was required to fit in with the clinical encounter

"*I go on a visit and clinically I have to go in and deal with what's there at the patient and sometime after the end of visit say oh by the way I have got this envelop would you have look through it and it is quite difficult to fit in*" CHF (FGD2 2009)

Such issues were argued to have hindered the recruitment of patients by healthcare professionals as at times talking to patient about RCT did not seem appropriate, for instance:

"*the police were there and it was all chaotic- antisocial behaviour, it was not appropriate on that day so I have it (get consent and complete questionnaires) to do in my next visit*" COPD (FGD3 2009)

In addition, the healthcare professionals noted that patients' reaction varied in regards to RCT assessment carried out during usual clinical encounter, and in some cases the patients seemed uninterested:

"*When talking about the questionnaires, …..it really depend on your patient because some of them will embrace anything, they will do that they think will help other then service where as others just mention the word 'research' or 'project' and you see them just sit back and shut down. We saw that chap yesterday. The moment I said oh.. this is study and I started to explain and you could just see him switch off immediately. So some people are put off a little bit by the word research. Because they think we are testing something out on them*?" CHF1 (FGD2 2009)

4.4.9 Trust

Trust is another attribute proposed to characterise the relationship between the IS innovation and the human agent. Trust in this research is defined as "*Questioning the degree to which IS innovation is perceived to be reliable and safe*".

Telehealth service deployment was identified to be an object of trust in three different forms, impacting technology trust, interpersonal trust and organisational trust.

Telehealth pre and post deployment

Technology trust

In the initial phase of the telehealth service, the healthcare professionals, especially the nurses showed little trust in the technology and questioned the reliability and validity of observations received. Two aspects were identified. One was whether the equipment was regularly calibrated and checked.

> "*I am not sure how long is this equipment in somebody's house for before it is tested? Just a regular check, you don't know if there is a hole in the blood pressure or getting the wrong reading or what?*" CM (FGD2 2009)

Second, there was concern about the abuse or misuse of the equipment. For example

> "*We had one chap who used it 14 times on a Saturday night when he had all his mates around and they all did blood pressure on it*" CSW (FGD2 2009)

Even after extended use, and after perception has changed, users still had not accepted the telehealth as being fully reliable. It would seem self-evident that building trust in technology should be a priority at the onset of the deployment.

However, later on the staff had observed that the telehealth service had improved the patients' trust towards technology because it provided the patient with information about their health status, and reassurance that their health was being monitored:

> "*… I think there was an increase in trust. Patients, of all the patients that have been on it, they thoroughly enjoy it. They enjoy it, they like it. They like the idea that they can monitor their own health as an example*" COPD (Interview1, 2010)

Interpersonal trust

The main issue raised with interpersonal trust related to the relationship between nurses and CSWs. Although, the nurses understood the need for CSW support in order to work efficiently and effectively, they were apprehensive of delegating their clinical task – reading and assessing observations received from patients (interpreting the results).

> "*he does look at the telehealth and reports back to me if there are any concerns. So that kind of does work. But, then I feel that actually now I have really not got any control over it, I have given it to him. When you delegate something you have got to trust someone to do that.*" CM (FGD1 2009)

After a year, the interpersonal trust between the nurses and CSWs was improved. Trust had been built by clearly defining the boundaries of actions that one was expected to perform, as evident from the quote below:

> "*we had a support worker coming into post, and we felt, you know, because it's purely monitoring, it's not interpreting, it's not visiting the patients or giving a prescribed course of action. We, you know, we have our support workers who took over that role*" COPD (Interview1 2010)

Organisational trust

Participants were concerned about how their workload and practices were being monitored and any consequence that might arise from this monitoring activity. They expressed concern about being monitored by the PCT for number of patient visits. At the time, the effort involved to undertake the telehealth was not incorporated into their workload and therefore, this might appear light and affect assessment of their "*effectiveness levels*". The nurses suggested that the new scheme might take account of visits saved as this would appropriately acknowledge their effort using the telehealth.

> "*The other concern I am sure goes across the board is the PCT obviously are very keen to make sure that everything we do is monitored so that we can prove how effective we are and currently we are having sort of fact-to-face contacts being monitored but not necessarily the telephone contacts that wet do. ....I suppose my concern is I don't want them to look as we are reducing our effective levels..effectiveness levels.. because we are focusing on phone calls from patients on telehealth rather than seeing patients on face-to-face basis*" CHF (FGD3 2009)

Where the concern was raised, the reason appeared to be as a result of the lack of adequate and clear communication between the PCT and the clinicians, which contributed to the feeling of 'distrust' and of being 'misled'.

> "*from when I had that initial meeting about it going in and from getting the paperwork which me and [name of the person] went through for which patients were suitable for the trial, we've heard nothing, absolutely nothing until this meeting. And I think that's probably where a lot of this has broken down, on communication, ...but if the communication's so poor in this direction then quite possibly the*

communication to more important people is poor as well and, you know, if communication's bad then it's unlikely to be successful" CSW (Interview2 2010)

RCT pre and post deployment

In regards to RCT, trust was challenged due to two main issues. First, the inherent design of the trial – randomisation - became a concern for healthcare professionals as they argued that this not only hindered equitable distribution of an intervention that might be useful, but also increased the risk of equipment allocation to clinically unsuitable patients such as those who suffered from anxiety or had dexterity problems. This point was also acknowledged by the project manager in interview carried out at later stage:

> "*I understand the arguments that… because then clinicians were also putting units into patients' homes that they didn't think clinically needed it, but they were in the trial. And they were saying, but I don't think… and I understand that the whole point of the trial was to prove that some patients, who we might not think would benefit from it, might benefit from it. But, I think they're still yet to be convinced and they… and I would rather they get them out and use them in patients that they think clinically need it, than push them through the trial.*" (Interview3 2010)

The second issue that was a concern to healthcare professionals included how some questions were worded in the questionnaires that required to be completed as a part of trial.

4.5 Discussion

This study had identified that a joint project involving telehealth deployment and RCT to evaluate its effectiveness was a very complex venture (Kaplan 2001, Taylor 2005, Armstrong 2006, Mort, May and Williams 2003, Finch et al. 2003, Williams et al. 2003).

The study also highlights the strategic flaws. For example, although telehealth had been piloted prior to the large scale deployment project, it had been at very small scale and involved only 10 patients. In addition, the pilot had been conducted more then two years before the launch of large scale telehealth service. This resulted in underestimation of the full scale of issues and realities that might arise when large scale roll-out would commence. Also, the configuration of equipment setup was different to the current setup and this impacted on how data was entered into the database such that healthcare professional had to enter data twice.

Furthermore, the need for full time and dedicated project manager due to the scale of study was not realised and in some ways can be argued to have contributed to the plight of overall project. Management neglected several small yet important aspects while planning to deploy telehealth. From participant's accounts it was clear that no point of contact was established. This resulted in staff being unsure of whom to call for assistance when issues arose. In addition, management failed to ensure that information on favourable evidence pertaining to the intervention was disseminated effectively either through using examples from other sites within U.K. or employing a champion, and thus failed to ignite staffs' interest.

In respect to framework, the findings are summarised in relation to each attribute:

Design
There were design concerns associated with telehealth and RCT. Concerns that were raised in relation to telehealth included installation and calibration, and issues due to software configuration. Although there were no direct concerns due to physical design of the telehealth equipment, it was highlighted that the equipment use might cause some problems for patients with disability.

Pertaining to RCT, issues that were highlighted included the timing of its deployment, staff role and involvement in recruitment, and the procedure of assessment and selection criteria (McDonald et al. 2006, Ammenwerth 2003, MRC 2000, Lancaster et al. 2010).

Efficiency and effectiveness
This attribute was articulated in relation to telehealth and RCT. Although healthcare professionals argued that telehealth deployment initially decreased efficiency by increasing their workload, those with experience of telehealth use argued that it held the potential to help them plan their day better in response to sudden emergencies and empower the patients by allowing them to self-manage their health. However, effectiveness of telehealth was related to evidence of its success in practice and examples of such success were argued to be scarce and therefore, healthcare professionals doubted its impact beyond what they had experienced.

In case of RCT, it was perceived to decrease the efficiency by imposing extra work that required nurses to assess the patients and complete questionnaires for the trial. Although this was an issue at the very onset of deployment, it left lasting impression due to lack of support. In hindsight, it was noticed that this contributed to perceiving RCT as an ineffective strategy for evaluation.

Optimality and equity

The attribute of optimality and equity was articulated due to both the telehealth and the RCT. Issues concerning telehealth included the cost of peripheral devices that in some cases was argued to compromise the quality of care, and distribution of equipment due to the trial.

In regards to RCT, the main issue of concern was equity (McDonald et al. 2006, Mair et al. 2007a, 2007b). Many participants had concerns over the non-equitable distribution of telehealth equipment due to RCT as this conflicted with their perception of delivering care to all patients equally. They also perceived patients were excluded through ethnicity that is whether they could speak and understand English. Such notions emerged as necessary considerations due to the selection criteria of the RCT.

Legitimacy

There were no obvious guidelines or clinical principles applicable to the deployment efforts of telehealth. However, evaluating technology through the RCT required fulfilling a very strict and comprehensive ethical approval process. Therefore, issues pertaining to the RCT were dominant in this attribute.

Issues such as the randomisation, selection criteria of the RCT, consenting, and possible withdrawal of telehealth equipment after the trial was over caused concern for the clinical users. They argued that such practices governed the provision and allocation of equipment to some patients while denied it to others (Finch et al. 2003, Finch et al. 2006, Heaven et al. 2006, Lankshear and Mason 2001, Greenhalgh and Russell 2010, McDonald et al. 2006, Ammenwerth et al. 2003).

Acceptability

It was noticed that acceptability was affected due to changes in routines and work practices (Gasser 1986, Joshi 1991), to which both the telehealth and the RCT contributed.

Issues that resulted due to telehealth involved installation of telehealth equipment, transferring data between the systems and training CSWs. In relation to RCT, procedures such as recruitment of patients, assessing patients and completing all the paperwork affected the acceptability (McDonald et al. 2006).

Over time, this perception due to increased workload changed, as some responsibilities were delegated to other staff. It can be argued that as time passed, negotiations were taking place and once the job roles were clearly outlined, the technology which once was seen as hostile,

was being normalised. However, these positive views were only expressed by nurses that were provided with CSW and dedicated engineer support. Community matrons still waiting CSW delegation did not change. Thus, the management need to consider optimal support to their staff and delegation of duties to avoid unnecessary and inappropriate workload, in this case equipment installation and maintenance.

Demand and efficacy

This attribute was articulated primarily in case of telehealth service. It was noted that the users' experience with telehealth and evidence of effectiveness affected its perceived need. It can be argued that this resulted due to telehealth only being used as monitoring tool and not as a substitute to clinical visits.

In addition, another contributing reason emerged from managerial level where issues pertaining to this attribute were more severe and related to the vendors of the equipment not providing enough engineering support and whose (McGrath et al. 2008) prime interest seemed biased toward making monetary profits and not building trustworthy relationships (Clark and Goodwin 2010).

It was also clear that while clinical users understood what telehealth encompassed they could not justify its need in this particular context (Cornford, Doukidis and Forster 1994, Hibbert et al. 2004, Finch et al. 2008). This might be due to the reason that geographically, nurses were used to travelling and visiting patients at home. The only role that telehealth played in this case was to enable prioritising of visits based on patients daily observations and then, where a visit was not warranted, by withdrawing a visit. This was noticed more evidently in the interviews carried out at post-implementation phase, and can be explained through the effect of perceived usefulness on technology acceptance (Chau and Hu 2001, 2002), where technology is accepted if seen as useful to work practices.

Expertise

The main perception was that expertise was being marginalised and was attributed to telehealth deployment and the RCT. Two main contributory factors were the lack of training and support. Particularly in case of telehealth, many instances where healthcare professionals struggled with telehealth equipment were shared. It was commented that at times, support was provided by staff who were familiar with telehealth prior to its big launch such as the COPD nurses and CHF nurses as they were aware of some issues resulting due to installing

and calibrating the equipment, rather than the dedicated engineer from the provider of the equipment or IT people within the PCT.

It was also argued that withdrawal of RCT can be associated with lack of support for initial assessment and carrying out other administration and enrolment work. Had this been provided, nurses would have carried their work as normal and service would have been evaluated as planned.

Interaction
This attribute is affected by both, the telehealth deployment effort and RCT roll-out.

The introduction of telehealth created a "*lifting out*" of care delivery by changing the context of clinical encounter. Prior to telehealth deployment, the clinical encounter would have taken place at the patient's home and facilitated through one-to-one interaction. This transformation in the context of care delivery leads to change in interaction pattern during clinical encounter (May 1993, Mort, May and Williams 2003, Hibbert et al. 2004, May 1992), and this threatens the "*deeply embedded professional constructs about the nature and practice of therapeutic relationships*"(May et al. 2001: 1889).

Whereas, RCT had no significant impact on the clinical encounter, it changed its purpose. Rather than the encounter primarily being focused on resolving immediate healthcare needs of the patient, it revolved around them being assessed as potential candidates for the trial (Rapley et al. 2006, Heaven et al. 2006).

Change in object of trust (from person to technology)
The attribute of trust was primarily dominant in regards to telehealth deployment. It is argued that although trust originates from the individual, the object of trust varies from being another person, an object or an organisation (Zaheer, McEvily and Perrone 1998, McEvily, Perrone and Zaheer 2003).

Clearly, in our study this was evident through the users' accounts of whether they could trust the technology to function accurately (Mort and Smith 2009), the patients to use the technology correctly and the CSWs to inform them in time of alerts. Such perceptions affect the 'telehealth readiness' of clinical users, where the term alludes to "*the degree to which communities, organisations, and professionals are prepared to participate and succeed in telehealth*" (Gagnon et al. 2006).

In addition, trust can affect the sense of responsibility and duty of care towards patients that is felt by clinical users.

In the case of organisational trust, the perception that telehealth allows surveillance and monitoring of the effectiveness of the nurses work fostered 'mistrust' and was perceived as threatening. Such a view has been described as 'electronic panopticon' (Timmons 2003), where the introduction of new technology has meant that nursing practices became subject to surveillance, although that was not its primary function. This ability of technology is argued to exert external force on the clinician and thus this will affect its acceptance (Jones and Orlikowski 2007, Jensen and Aanestad 2007b). In Nottingham, this concern persisted among some nurses although some were unaware of such an activity.

A lack of communication leads to further deterioration of the relationship and creates tension between the clinicians and management. If surveillance is necessary, clinicians should be informed and allowed to express their opinions. It is argued that in modern societies people reflect on their actions and learn from them, and if surveillance is promoted as a self-assessment tool then employing it would not be considered an issue.

4.6 Summary

By drawing on points above, the author argues that attending to the attributes of the Triality framework has enhanced the analysis of the reasons for understanding both the successful and contentious elements in relation to IS innovation deployment and its evaluation. It highlights that while some attributes play an important role during the deployment, others play an important role during evaluation. Taking these differences into account, it is possible to facilitate successful assimilation of innovation.

Moreover, the findings and discussion of this case study can be interpreted and mapped to other IS innovation deployment and evaluation efforts to better manage such projects, and the points that can be taken into account are:

- Healthcare professional buy-in should be priority, and it be gained at the very initial stages of planning to get or procure IS innovation. This is important as buy-in at this stage affects the "*relational integration*"[9] (May et al. 2009), of clinicians. Getting

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[9] Is defined as *"the network of relations in which clinical encounters between professionals and patients are located, and through which knowledge and practice relating to a complex intervention is defined and mediated"*

them on board before starting would allow them plenty of time to become accustomed to the idea and feel valued.

- Healthcare professionals should be asked about what they require in terms of support and training as they are aware of ways in which such services can be customised.

- Healthcare professional should be presented with exemplars of services that have attained normalisation and have become a success story, and they should be allowed to talk to fellow colleagues from such sites and even visit the sites to get the feeling of how and why the deployment took place and how the benefits would be realised.

- The moral and ethical dilemmas of clinicians, along with the fear of litigation, should be addressed by presenting clear guidelines and procedures, adhering to the standards of best practice and enable the vendor to talk to clinicians

- Organisational managers need to have clear goals and vision to understand why such deployment effort is required, who will be affected by it, and who will benefit, what are the resources needed in terms of cost, support, and maintenance. When such visions are clear at the top level, it is easy to articulate them to the clinicians who will be using such services. Enlisting the goals and needs of the organisation for the service will also allow clinicians to understand why the services are needed (Barlow, Burn and Lockhart 2008, Iles and Sutherland 2002).

- Once visions and goals are identified, vendors should be carefully selected and once selected, multiple stakeholders should be allowed to communicate with each other including the patients. This would also enable better definition of the IS innovation in question (Hüyrinen, Saranto and Nykanen. 2008).

4.6.1 What is coming next?

Having described the applicability of Triality framework in understanding telehealth deployment and its evaluation through RCT, and having outlined the difference between the role of each attribute pertaining to these two processes, we now move to assess the transferability of the conceptual framework and thus potentially further suggest its value. To do this, we employ the case of electronic record deployment in the U.S. This captures a richer and more complex context, an IS innovation that is subjected to many iterative changes and involves a much wider set of stakeholders.

Chapter5: The case of EMR/EHR deployment

5.1 Introduction

In this chapter the case of EMR/EHR deployment in U.S. is used to evaluate the transferability of the Triality framework to different healthcare contexts. This approach provides a deeper insight into the added dynamics through which the various attributes are articulated, and enhances understanding with respect to the interrelationship between the various attributes of the Triality framework. This is achieved due to the iterative nature of IS innovation (electronic records) in this study.

5.1.1 Chapter Outline

The chapter starts by presenting an overview of the U.S. healthcare system. It then progresses to outline how data was gathered from an online discussion forum. This is followed by results, where each of the attribute and the dynamics through which it is articulated is presented in detail. Reflections on the findings are discussed and summary is provided.

5.2 Case description

The U.S. healthcare system is complex. It is a mix of private and public funded systems, and comprises primary, secondary and tertiary care organisations. Generally, different organisations provide care at different levels and cluster together to form a regional healthcare system. Often, in one region, there can be more than one healthcare system (Roe and Liberman 2007).

Healthcare systems are largely insurance based with two third of the coverage sponsored by employers. Government funded insurance includes Medicare and Medicaid programmes. Medicare covers U.S. citizens who are 65 years of age or over and disabled. Medicaid on the other hand provides cover to children, those whose income falls below threshold and the disabled (Roe and Liberman 2007).

The complexity of the system, due to its structure and different types of insurance models requires delivery of care to be streamlined. This necessitated the need for electronic records that would help improve care delivery processes, improve patient experience of receiving care and save cost. To promote their procurement and deployment, changes in policies have followed (PCAST 2010).

Taking this into account, the case study employed in this chapter, looks at the efforts of electronic record deployment. It aims to gain a deeper insight into the reasons preventing successful deployment and why such an IS innovation has not yet been assimilated into daily work practices of healthcare professionals.

The term electronic record is used in this chapter to encompass both, EMR and EHR (as presented in chapter1). This research adopts this position to highlight the issues arising in design of this innovation due to prevalence of ambiguity in correctly defining them.

5.3 Method

In this chapter, the data was collected using online discussion forum from LinkedIn. LinkedIn is defined as "*a business oriented social networking site*". It was created in 2002 and was launched in May 2003 (LinkedIn website: http://www.linkedin.com).

One of the important features of LinkedIn is its group discussions, which contains various discussion threads. In this thesis, the discussion threads chosen were from Healthcare Information Management Systems Society (HIMSS) group which is defined as the group that facilitates "*constructive and stimulating discussion regarding the optimal use of health IT (HIT) and management systems for the betterment of healthcare worldwide. The goal of the discussions forum and subgroups is to lead change in the health IT and management systems field through knowledge sharing and communications among professionals*". It has 48, 104 participating members.

The main thread included 1,019 comments posted by 336 participants. Two further threads were spin-off, where participants from main thread had initiated a new discussion related to the original topic but sufficiently different to warrant a different thread.

The main discussion thread continued to grow over 13 months (24th Nov 2009-24th Dec 2010), and was still active at the time the research concluded. Over the period of 13 months, new material continued to be added. However, at the start of 14th month, and although new thoughts were still being expressed, the participants recognised that posts were carrying repeated messages and meanings. At that part, no further comments were collected and analysed as it can be argued that data saturation had occurred. This phenomenon is common, such as in case of the study where to understand the enactment of computed tomography

(CT) scanners used by radiographers and technicians, data collection was stopped after 12 months when the same patters started to emerge and it was concluded that most of the interaction had been recorded (Barley 1990).

The data from discussion threads was analysed as documents using the thematic analysis approach as outlined in chapter 3. Care was taken to account for each participant and relate their post despite the contribution being in spin off threads.

Discussion thread	Participants	Comments
Discussion thread1on EMR/HER failure	336	1019
Discussion thread2 on difference between EMR and EHR	20 (6 of whom also participated in other discussion)	35
Discussion thread3 on EMR/EHR success	35 (14 of whom also participated in other discussion)	65

Table 4: Breakdown of data from discussion threads

5.4 Results

Results in this section are presented to identify the contributing factors encompassed within each of the attributes of the Triality framework.

It is important to note that in this section the terms clinician, physician and doctor are used interchangeably, as these terms were used by the participants in the discussion threads.

5.4.1 Design

The design of this IS innovation was seen to be affected by many factors, and was the most commented upon topic in the discussion. Two main sub-themes emerged during the data analysis: the technology design, and the vendor procurer relationship.

Technology design

Many participants reported that the EMR/EHR design features were the most contentious and the greyest of all areas. On one side were those who maintained that customisation of applications solved the issue of acceptance, whereas on the other were those who maintained that customising was a waste of resource and resulted in applications being rejected due to the added complexity. They claimed that standardised packages were the way forward as only 10% of features were used and customisation was expensive. In addition, opponents of customisation argued that vendors used the term customisable as a selling point. Proponents of customisation however, suggested that lack of customisation and using off the shelf packages compromised workflow process, nor did they capture the contextual requirements of the setting in which the application was to be deployed and used. The following example shows how customisation done after listening to end-users requests changed what seemed to be a failing IS initiative to a success:

> "*In my previous job; I needed to accept a gynecologic EMR with more than 200 fields. The manager refused to simplify and for sure we build the best gynecologic EMR. One year after the beginning, 10% of the data were fulfilled. The medical manager accepted to simplify and we transformed 200 fields to less than 40. One year later we had 89% of the data collected. It was the major field and it was a success*" #714 Consultant at French Ministry of Health

However, with more than 300 EMR/EHR applications available in the market and more than 400 vendors, no doubt this tug of war between customisation and standardisation remains troublesome to resolve, especially, when there are no legal standards to abide by. Three main design features that caused strong contending opinions were identified as interoperability, data capture and, data extraction and storage.

Interoperability

Of the three issues, interoperability was the highest priority. Participants would differentiate between EMR and EHR and their respective interoperability requirement. EMR was normally used to refer to the repository of patient medical record belonging to a single organisation such as a hospital, and the requirement was to integrate different departments such as laboratory, pharmacy and physician's office to create a single patient record within the organisation. EHR was normally used to refer to the collection of information from separate organisations such as hospitals, and other clinics, and therefore, requires different EMRs to

operate together. There the requirement was interoperability to achieve co-ordination and collaboration.

Middleware was often suggested to resolve the issue of interoperability. These systems allow data extraction and format it according to the organisational infrastructure, but add to the overall cost and complexity of the system.

Security issues were frequently discussed, and the perplexities of the long list of regulatory requirements, internal and external guidelines caused many to express nausea; with the apparent lack of consensus between the policy makers, regulatory bodies, procurers, users and vendors leaving organisations with an EMR that is 90% functional, the EHR capabilities lay unused. In some cases, participants reported that each department within an organisation have a different EMR. Such instances of failure to coordinate and collaborate are perceived to be detrimental to the organisations with respect not only to the cost incurred but also the risk posed to patient's health:

> "*I had to rush my wife to the ER (Emergency Room) for what I thought was a stroke and turned out to be an adverse drug interaction from a new prescription. Upon presenting in the ER we provided a copy of her medication list; upon being seen in triage, we gave them a copy of the medication list. I applaud that we were seen within 15 minutes in an exam room and already had ER and Neurology specialists checking on her.......funny that those physicians couldn't access any information we had provided at registration and triage (and the hospital HIS is from a very well known vendor)....so we gave them a copy of the medication list.*" Discussion thread2, #20 Director of business development.

How this lack of interoperability contributed to cost and, had it been achieved, then how it might have contributed to cost saving is described in following example:

> "*For instance you present to your primary care provider with low energy levels and sleeplessness. Your PCP(Primary Care Physician) examines you finds nothing and scripts you for a blood test. The test shows nothing unusual to him so he sends you to a Hematologist.*

The specialist (Hematologist) asks the routine questions like have you been out of the country lately etc. etc. and decides to send you for a blood test. This caregiver notices that you have low testosterone and prescribes, let's say "testin"(a form of a drug) and tells you to call him if your energy levels don't improve.

After a few weeks you start to experience terrible muscle cramps in your stomach and sides. You visit your PCP and he examines you and advises you to take in more fluids and eat foods high in potassium. A few more weeks go by and the cramps have intensified. You revisit your PCP who decides to review your medications. You find that he doesn't mention testin as one of your medications which the specialist prescribed. He informs you to stop taking testin because it contraindicates with one of your other medications.

Two things have happened in this scenario that could be remedied with a longitudinal medical record.

One: because the specialist did not have an accurate patient medication list he prescribed a drug that could have seriously injured a patient. (Patients don't always remember every medication or the dosage they are taking). This is one reason caregiver insurance is so high.

Two: The specialist was unaware of the blood test prescribed by the patient's PCP and therefore ordered a redundant ($500) test. This scenario is played out thousands of time per day all over the Country. (Imagine the costs)."# 110 President and CEO, HIT

Data capture

The second feature within design was data capture and it had four sub-themes contained within it: the quality of the data; type of data captured; purpose of the data captured; and the mode in which it is captured or who is responsible.

In terms of quality of data entered, it was argued that only 90% of data entered was useful. Whether this 90% data was usable and held any value or not, was the cause of the greatest comments on this topic by the participants. It was argued that not all the data entered was clinical, much of it was used for legal and insurance purposes, and therefore the data captured

had different values for different stakeholders and varied according to speciality and environment. For example in order for the hospital to be reimbursed accordingly, the

> "*data gathered should define the work effort of the healthcare team and tie it back to the CPT and ICD-9/10 billing information so that the care provided it easily traced to the care billed. Here is an example...insurance companies pay hospital stays by revenue codes. Revenue codes in the 200 represent intensive care, which represents care being provided every 1-2 hours. There is an intermediate critical care code (214) which represents care being provided every 2-4 hours. Medical/Surgical care revenue codes are in the 100s and represent are being provided every 4-8 hours.*
>
> *What is the cost of a patient that gets care every 1-2 hours? What is the cost of a patient that gets care every 2-4 hours...you get my drift. On top of this data being important to gather for billing reimbursement it also defines the acuity of the patient and how a floor should be staffed. Now we are talking about staffing. If a nurse assigned in ICU does not document that she made an intervention every 1-2 hours the insurance company won't pay the intensive care rate*" #661 RN, Emergency room case manager

In terms of type (structured such as demographics, e-prescription; and unstructured such as patient history) and format of data captured by physicians, it was argued that they preferred to capture information about their patients in the form of narratives that provided a holistic picture. However, few applications allowed this. Instead, data was captured in the form of a tick list and any additional information was added through a separate box either on one side or at the end of the page. This approach was not liked and clinicians considered that it reduced patients to a tick box list.

In addition, it was argued that due to new and forthcoming changes to billing codes (ICD-10)[10]:

> "*the majority of physicians will prefer to pay for coders and billers to handle reimbursement for the them instead of wading through 60,000+ diagnosis codes and*

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[10] ICD-10 stands for International Classification of Diseases, Tenth revision by World Health Organisation. It is used within hospitals to classify patients according to the conditions and ailments suffered by them.

an ever-changing set of rules on coding and billing procedural codes"#980 Coding Supervisor.

This issue therefore, called for the EMR/EHR to be seen as an entity encompassing two parallel systems, one a repository of data for clinical decision making and the other as an administrative tool for billing.

Direct data capture during the clinical encounter by clinicians to record their encounter caused more problems through poor typing by the physicians. Some organisations resorted to scribes who followed physicians and would enter the data during the clinical encounter on their behalf (for more information on scribes refer to page 132).

Data extraction and storage

Data extraction and storage is the third feature that encompassed comments on the issue of design. Many commented that unnecessary data generation and documentation was a common practice and they perceived no real need for it:

> "*At the risk of being labelled a nutcase, I bring up Nazi Germany. They became famous after WWII for having incredible amounts of documentation of the atrocities they committed. Why did they do that? Apparently, because they could. But there was no discernable point to all their documentation, except to make the lives of the Nuremburg prosecutors easier. It's kinda scary to consider that as an historical precedent for our current health care system, but the parallels are indeed present*" #656 Healthcare and hospital professional

It would appear that many of the features to extract and store data were perceived as being useful only to protect organisations against litigation; however, the process itself was adding to the risk and compromising the security of patients' information due to the storage issues of the location where it was stored. Many participants argued that cloud based computing and storage posed a significant threat to breach of security and safety and this would especially heighten during occurrences such as power cut or natural disaster. However some argued that cloud based computing is highly cost effective and efficient:

"Imagine an office in which you don't have to buy a copy of Windows for every employee or for that matter provide costly desktop computers. All you need is a connection to the internet and a browser. File storage, application deployment etc. all distributed through the cloud. Health IT is a big cost at least to get the quality that is needed. If you can lower the costs of application deployment and still provide the necessary functionality and security for EMR/EHR, then it should be viewed as a viable option" (#550 Technology consultant),

Also the issues related to safety and security are unfounded since:

"The latest security analysis by a variety of government agencies and analyst shows that over 80% of data breaches occur internally by employees either mis-using data or for malicious reasons." #551 Software sales executive

In addition, the ability of EMR/EHR to generate useful data patterns from all the data captured and stored was doubted and often seen as lacking. As one specialist puts it:

"EMR systems are built to count widgets and dollars not the complexities of human experience. Imagine if you will (have) two images. On the left is a Google Map of a city from about 1000 feet, enabling you to see curvy roads, a few driveways, a highway, etc. The image on the right contains columns of boxes arranged by size and color. Our problem is EMR tries to put unstructured data like exists in the map into structured containers like the boxes on the right. Storage and retrieval are poorly executed and user experience is cumbersome. No wonder everything slows down and clinicians resist. It's like trading in your MS Word for MS Excel to be your new word processor. It will accept the text, but it sure makes reading and writing difficult" #161 Training and prevention specialist

Furthermore, where the EMR/EHR was requested to produce a summary as a portable record it often failed. As noted by a healthcare professional:

"I think right now that about 95% of patients whose records are in an EMR would find that if they asked their doctor for their "copy" of the record they would get, at

best, an incomplete summary of their most recent visit. Most would get a blank stare or a mumbled excuse..." #991

Design issues are not restricted only to the technology. The design is influenced by many stakeholders, and among them are the providers/sellers/ vendors and procurers/clinicians/users/buyers. The next section highlights how design of a complex IS innovation is further complicated by the tension between the vendors and procurers.

Vendors vs. Procurers

Among the various stakeholders involved in dealing with EMR/EHR applications, vendors are regarded as the most notorious to deal with because their sole interest lies in selling the applications and making profit. They are accused of selling old systems wrapped up as new and a quote below expresses this stance adequately:

"*The reason the IT systems "look antiquated" is because they usually are antiquated. Often vendors have an old software product that has been in existence for many years. In their hurry to meet new market demands; i.e., healthcare reform legislation, they simply put "lipstick on the bulldog" or a new front-end, like newer looking menus, newer looking screens. However, what is behind the "new" look is the same "old software*"" #614 IT manager

Furthermore, they are blamed for misleading the clinicians while selling applications that either do not need the extra design features or even lack the very essential ones, as explained by an example below:

"*1. Vendor entices doctor with "EMR that takes 50% less time to enter orders"*
2. Doctor buys this EMR software.
3. Doctor finds out that software is 50% faster because the medication orders are all pre-filled in a way that doesn't match the physicians' needs, or cuts corners on safety.
4. Doctor is ultimately frustrated with outcome" #747, MD and chief medical informatics officer

It would appear that vendors take advantage of IT illiteracy among clinicians and managers involved in procuring the application. Furthermore, it seems that they are free to do as there

are no penalties involved. At times participants argued that vendor solutions were designed by people who had no sense of real workflows and therefore, the IT people from the vendor side should do more than just "*hang around*" because they think that they might know the solution, whereas the correct solution may be far from being conceived. There is a tendency for the design to be overcomplicated and result in misfit of expectations:

> "*The technical teams believe that they can spend a few hours in the providers' offices taking notes, then go back to the lab and decide what to produce for the users. This is no different than if I decided that because I am a provider I could produce an EMR by simply hanging around an IT lab and taking notes. This approach reminds me of the commercial about the guy who can solve any problem because he slept in the Holiday Inn the night before*" #160 MD, Senior medical consultant

Matters are further complicated after the vendor's IT people leave, and when in-house IT people are asked "*to write spaghetti code on top of the vendor's spaghetti code, to try and satisfy the clinicians' needs*" #467 IT manager. There was a feeling on the procurer's side that vendors did not appreciate that each setting, whether a hospital or physicians' clinic might be unique and have different workflow patterns and routines. Therefore, a poorly designed package that does not address this aspect will not meet the demands and expectations of the end user.

However, some argue that such scenarios are common and often ignored due to the difference in culture:

> "*I have to agree that the clinical experts and software vendors are from completely different cultures. In the frustration that ensues, the "keys to the Ferrari" are handed off much too soon*" #499, Manager, Recruiter

In addition, participants highlight that the cultural clash does not allow the clinical and the IT personnel to play "*well in the sandbox together*" (#15 Data Analyst) because "*the IT folks are focused on getting the new technology in place, while the clinical folks are focused on treating the patients*" (#220 Healthcare managing director) and both parties speak different language without understanding what the other party is trying to say. This often leads to scenarios as:

"1. Doctor asks "I want a machine that hits the road!"

2. Informaticist develops a plan for a machine with a hand that hits a few square feet of pavement on a table.

3. Informaticist develops the training plan, curriculum, figures out where the machine can be used clinically, tests the machine with whatever clinical staff are willing to be available (often not a physician), and develops the go-live plan.

4. IT expert builds the machine with a little cartoon hand that hits the few square feet of pavement on a table.

5. Go-live plan is activated.

6. Doctor, on seeing the machine, says, "That's not what I meant - I wanted something that I can drive away from here, quickly!"" #747, MD and chief medical informatics officer

Although amusing, such instances are far too common and, not as in this instance, are accompanied by unanticipated consequences. Such instances play an important role in creating a perception where procurers see vendors as the drivers of the market without knowing its real scope and implications, and whereas the vendors see the procurers as reluctant to bridge the gap by speaking a common language and learning new ways:

"Most Physicians that I have worked with on EMR / EHR installation will ask me a question about how something works and then lose focus and go all googly eyed when I try to explain it to them. We simply do not understand each other's languages" #731 EMR services, Founder and owner

In addition, the vendors maintain that clinicians do not cooperate and hence, do not fully commit themselves to the real scope of implementation and deployment efforts:

"doctors view "buying an EMR" the same way they buy a car. They spend months of research, take many test drives, bargain hard and then finally, make the purchase. They think they've accomplished the goal when it is only just the start" #626, Managing director, healthcare information

In summary, according to vendors clinicians "*need to park their egos and listen*", as "*they are so well educated, that they don't know that they don't know*" #7, Healthcare practice, leader and founder

The lack of consensus among the clinicians themselves (that does not just include physician-physician but nurse-physician) is regarded as the most daunting task by the vendors:

"*I worked in a 6 Physician Partnership where one week you could get the physicians to agree on the layout of an H&P form (History and Physical examination form) and then the next week you were designing 6 different H&P forms. Physicians by nature believe that how they do things is always the best way to do things no matter how much extra work it causes the rest of the staff*" #240 EMR services, Founder and owner

And,

"*1. Doctor1 reports "I want a simpler EMR!"*
2. Doctor2 reports "I want a simpler EMR!"
3. Neither doctor1 nor doctor2 want the same EMR software" #747, MD and chief medical informatics officer

These instances lead to situations where no one is ready to listen to the other party and everyone is busy speaking their own language, thereby enacting practices that are unable to distinguish between the "*substance and form*" as elaborated here:

"*Substance is enduring, form is ephemeral. Failure to distinguish clearly between the two is ruinous. Success follows those adept at preserving the substance of the past by clothing it in the forms of the future. Preserve substance; modify form; know the difference. The closest thing to a law of nature in business is that form has an affinity for expense, while substance has an affinity for income.*" #453 Director of Healthcare Information Systems

Hence, with managerial, administrative, clinical and professional stakeholders from the procurer side and many more stakeholders from the regulatory and vendor side, efforts should be diverted to understanding a common goal and vision.

5.4.2 Efficiency and effectiveness

Pertaining to EMR/EHR, efficiency was more dominant aspect than effectiveness within this attribute. In this study it was noticed that efficiency applied at individual and system level. At the individual level, it include assessing how the intervention improves current working practice thereby allowing more tasks to be accomplished than previously possible. At the system level, it measures the cost benefit, i.e. how much was saved, and overlaps with optimality. This section discusses the factors that affect this attribute.

The direct relationship between poorly designed EMR/EHR applications and low efficiency was the most discussed issue. Once again, old packages sold as new were blamed for the slow speed, and one participant compares it to "*driving this Lamborghini in 1st gear*" #58, Infrastructure architecture.

Compromises due to customisation or standardisation were argued to affect how well the package would respond to the need of the customer and therefore how well it performed when used. For example, an off the shelf package that would take ten steps to order a specific diet for a patient can be customised to finish the same task with three-five steps as explained:

> "*10 steps to order a patients diet electronically. How can that be "efficient"? Compare that to the paper way- MD writes order, order faxed to Nutritional Services dept., pt. receives diet/nutritionist consulted*" 474, RN, Subject matter expert and business analyst

Efficiency is affected by gaining expertise in using the package. Therefore, it can be argued that the longer it takes to learn, or the longer the learning curve, the slower will be the efficiency of the intervention realised. However, with time, benefits of these systems are appreciated:

> "*When I assisted doctors with our new EMR solution they would say...if I was a student-learning this would be ok, but I am in business for myself and it is wasting my time. It became useful when they realized they could sign their charts at home and their staff just had to log into a computer to get reports and didn't have to call or wait for Medical Records staff to fax them over*" #704 RN, Emergency room case manager

In addition, efficiency is affected by the apparent need of the package. If the system is plagued with uncertainty over the controversial features such as interoperability, co-ordination etc, and allows the user to do nothing with these feature but just facilitate the billing process, the application will never be used and will lay dormant. Furthermore, these ineffective design features affect the work flow; which might not even have been looked at before implementation, despite the clear requisite to understand them:

> "*If it takes 3 minutes to perform an action in an EMR vs 1 minute on paper, and the patient is already complaining about getting shorted because the insurer pays based on a 10 minute exam time, and the doc doesn't want to go broke, what's gonna happen?*" #576 Hospital and healthcare professional.

Additionally, if the EMR/EHR package design involved transcription software, then training for the software required time and effort, which physicians were unable to afford.

A further factor that influences efficiency is the lack of support for clinicians. An example would include assigning data entry clerks to save clinicians time and therefore help in coping with the increased workload. However, although seen advantageous, there was criticism:

> "*those data entry clerks are among the most inefficient - they don't know how to type well, and don't want to learn (and shouldn't have to...)*" #576 Hospital and healthcare professional.

5.4.3 Optimality and equity

In this attribute, the equity aspect was not a cause of concern. It was optimality that many participants commented about. Defined as balancing improvements in health against cost, optimality encompasses the relationship between evidence and the cost associated with it. Therefore, to be considered as an optimal solution, the intervention needs to show that it facilitates attaining health benefits and also is cost effective. From the discussion, the message conveyed with regards to EMR/EHR optimality, was that so far there is no clear benefit; neither in terms of monetary nor health improvements achieved through its use. A number of reasons were listed as contributing to this conclusion, and are discussed below.

Lack of robust evidence on the EMR/EHR was considered to be the first contributing factor. Earlier it has been discussed that limited evidence on monetary and health outcomes is not conducive to EMR/EHR acceptance. However, when benefits of an intervention are realised, acceptance and assimilation are greatly increased:

> "*Early on I worked with a small group of Docs, 110, in driving best practices around a disease management program. Success and buy in came when they were shown their outcomes after practicing a best practice and the difference in outliers that did not accept the program*" #175 RN, Senior consultant and project management

In addition, the EMR/EHR is currently seen as a repository of legal and insurance information rather than health information, and many argue that this does not contribute to its usefulness as a healthcare delivery tool. Moreover, even if it were accepted as a medical tool, the inherent design of EMR/EHR applications is counter to the way clinical end-users makes decisions which is based on knowledge and experience, rather than algorithms that are designed to lower cost by providing standards (partial if not complete) for care delivery. The decision making processes are especially challenged when patients with complex problems present:

> "*In medicine, TB and syphilis are both known as "the great imitators." That is, both of those diseases, depending on the individual's illness as well as on the time course of the disease relative to presentation to the physician, can mimic hundreds of other diseases. And they are not alone - there are, literally, thousands of disease processes which can mimic others. The television show "Mystery Diagnosis" is based entirely on the phenomenon. But both diseases carry a social stigma, and no physician wants to be the one who incurs the wrath of the patient for even suggesting that s/he could have such a disease.*

> *Another trusted adage of medicine is "If you hear hoofbeats, think horses, not zebras." That is, when you see a set of symptoms (e.g. an ulceration around the mouth) which could either be a simple, common illness (e.g. a viral infection - the common cold) or a more severe but less common problem (e.g. syphilis), there is a much greater likelihood that it is the common disease, and that is where treatment should be directed.*

And there's a balance between the two issues. A huge number of diseases mimic each other, but investigating every possibility for every problem requires enormous expenditures for additional testing, etc - the infamous "million dollar workup"(expensive diagnostic evaluation initiated at patient's complaint or request) is a term familiar to many, and much hated by insurers and the government.

But the EMR ignores all this. I have yet to see an EMR that does a good job of assisting with the iterative process that complex diseases require for diagnosis and/or treatment. Most don't even try, and the few that do, do little more than simplify the process of looking up earlier diagnostic decisions from prior visits. Even third party decision support systems tend to focus on aiding the discovery of a diagnosis based on the current visit only; progress is being made, but the vendors fear the malpractice attorneys almost as much as the physicians, and are shying away from really pushing the effort." #8?? Hospital and healthcare professional.

High costs due to implementation efforts, training, extra support such as data entry clerks and transcriptionists, design feature updates and legislative issues constituted the second contributing factor. These issues will be discussed in the following sections.

5.4.4 Legitimacy

Legitimacy issues surrounding EMR/EHR implementation arise firstly, due to the various legislative requirements/standards (also known as healthcare bills in USA) that govern areas of data capture, storage, sharing and extraction. Secondly, they arise because of the ethical dilemmas experienced by the potential user. This section presents detailed account of the ways in which these two factors relate to the attribute.

Legislative requirement/Standards

Failure to fulfil the requirements laid out by various standards and legislation such as the HITECH Act[11] and HIPAA[12], can cause conflict over liability and negligence, thereby leaving the establishment with a hefty bill to pay as well as a potential fine. Many

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[11] HITECH stands for Healthcare Information Technology for Economic and Clinical Health act that aims at providing incentives to those providers who demonstrate meaningful use of healthcare technologies (in particular use of EMR/EHR)(PCAST report to the US president, 2010)

[12] HIPAA stands for Health Insurance Portability and Accountability act that lays out administrative, technological and physical safeguards to secure and prevent abuse of healthcare information.

participants argued that compliance and adherence to these legislations were "*killing*" the organisations due to the cost involved in enacting the procedures according to the standards, and maintaining the packages over time such that every time a change in a standard was made an update had to be brought. This affected the vendors too, who constantly had to monitor the changes and then provide the service to their clients.

The participants ushered to the fact that the legislation was complex due to the privacy rules involved (inter and intra) and this confused not only the procurers and potential users, but also the vendors who were designing and selling the EMR/EHR application. This plight was worsened due to the complex organisational structure of healthcare and the complexity of technology. An example was the case of 16 employees from a healthcare organisation who were dismissed when they were found guilty of breaching security by unintentionally browsing through a physician's electronic records. Those employees subsequently were potentially able to sue the hospital as they were never briefed on this aspect. This highlights the level and severity of confusion. In addition, this also leads to confusion over "*basic governance issues (like Robert's Rules - What is a committee? What is a charter? What is a policy manual? Who is responsible for what part of it?) can be challenging because we keep two policy manuals in medicine (clinical AND administrative), instead of just one*" #721 MD and Chief medical information officer

In addition, the complex list of regulations from 150 agencies caused the design of technology to be complex as:

> "*it has almost nothing to do with patient care, very little impact on quality, and makes negative economic sense. But by and large they do manage to meet the conflicting, illogical, counterintuitive, pervasive regulations that are out there*" (#863, Hospital and healthcare professional).

Moreover, these regulations have no real focus as portrayed by the comment:

> "*With EMRs the business case and the medical quality improvement argument are both weak, at best (It's important here to differentiate between improvements in medical quality and improvements in documentation quality.) Physicians have not rebelled against regulations regarding CT scanners because they were directed*

115

primarily towards patient and operator safety. There is no equivalent argument for EMRs - only the demands by the bureaucracy to meet regulations designed for the bureaucracy" #869, Hospital and healthcare professional.

It was also highlighted that organisations often hastened the process of implementation in order to meet the deadlines imposed. Such decisions caused more harm than good at a later stage as they led to poor definition of future goals and vague future vision. Therefore, it was argued that externally imposed deadlines on standard implementation not only caused chaos among the various stakeholders within the organisation but also impacted organisational readiness "*by putting a gun to the heads of organisational leadership*" #549 Hospital and healthcare professional, and "*creating a perfect storm*" through healthcare reform #993 Coding supervisor-U.S. Army

Many more argued that standards were politically driven by those in power positions and often ignored the realities of how they might impact the practice of care delivery such that they mandate plans for patients but not the accountability. This is illustrated by one hospital and healthcare professional:

> "*In most cases, the executive directors are career lawyers. They know nothing about medicine, but they do know how to catch the scent of the political winds. And that has much to do with standards development, but has nothing to do with its appropriateness from a medical perspective*" #677 Hospital and healthcare professional.

This political inclination of standards was reflected on, firstly in terms of the actual focus of standards. Participants stated that standards were more supportive of the administrative side such as billing than clinical issues such as best practice. They therefore, were not aiding and adding value to clinical practice but rather imposing more work, as can be noted by a comment of an IT manager who reflected on the suggestions proposed by an influential group on mammography:

> "*I remembered the New York Times article, Jan. 16, 2010, re: the XXX Task Force said that, "Most women should start regular breast cancer screening at age 50, not 40, according to new guidelines released Monday by an influential group that provides guidance to doctors, insurance companies and policy makers." It also says*

> *"women age 50 to 74 should have mammograms less frequently — every two years, rather than every year. And it said doctors should stop teaching women to examine their breasts on a regular basis." "*#681, IT manager.

The clinical participants therefore debated over the real impact of using such standards (which were either lacking or were so many in number) or guidelines. Why this might be the case is exemplified below:

> "*there are very few strong cases that demonstrate an actual improvement in health outcomes due to adherence to guidelines. That's partly because it's still a pretty new undertaking - there simply hasn't been enough time to achieve success, but more so (in my opinion) due to the difficulty in demonstrating the (nearly always) very small improvements that derive from guideline adherence*" #682 Hospital and healthcare professional

Secondly, in terms of incentives provided by the government, participants commented that incentives that were provided were far outweighed by the actual cost of implementation, including procurement and cost incurred during the training period. Instead, these nudges were described to have hidden political motives, as one participant stated:

> "*This is about the good ole' problem of special interests from healthcare & Rx lobby, receiving payment for political contributions to Obama et al. Notice how Obama gave the mandate to providers ...thou shalt implement these expensive IT systems that a few monied interests own. And notice what an effective job those lobbyists have also done in convincing the healthcare CEOs and CIOs that they must have consultants on deck that are billed by that company at exorbitant rates!*" #547, IT manager

In addition, such incentives provided a stage for vendors where they ventured outside their territory of expertise thereby risking their reputations and misleading their clients. This resulted in the more immediate problem of the inclusion of the design features within the applications; to such an extent that in some instances 80% of design features were either not compliant or lay dormant as their users fear consequences resulting from their use.

Despite the majority of participants critiquing the current legislative stance, some believed that leniency and a non-penalizing approach is the cause of slow adoption. If strictness is

adopted, and requirements are mandated, both vendors and procurers will be bound to comply and make organisations more active. Such an initiative was compared to an opportunity as historical and charismatic as that of the moon shot as described in the quote:

> "*We use to try new things in this country. Remember the Kennedy speech:*
> *We choose to go to the moon. We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win, and the others, too.*
> *Getting these EMR systems to work is our moon shot*" #538 CEO, Engineering

In addition, mandating standards and imposing deadlines was heralded by some as an enabler for organisations to move towards achieving the outlined vision rather than waiting for others to go first and hope to learn from their mistakes; and for vendors to be more innovative.

Ethical dilemma

The attribute of legitimacy also includes ethical issues. It was argued that using some technological IS innovations works against the medical profession's ethics for example:

> "*when I was hospice nursing we implemented specialized hospice software, were given these great little computers and blackberries as our new "pager" essentially.. sent off with them and told to get our charting done DURING our patient visit!!!! Can you imagine? I refused to take my computer or my phone into the house when I was caring for dying patients and their families*" #578, RN, Subject matter expert and business analyst

As suggested by the participant, IS intervention poses a moral dilemma, its acceptance will be problematic. EMR/EHRs are also seen as tools that aim at standardising care, which is deemed to be acceptable in some cases. However, while dealing with complex cases it was seen as rather unnecessary and against the ethos of medical practice, especially when it is driven by cost. The quote below explains this point:

> "*When one decides to impose a "standard of care", what one is really doing is defining a cutoff. If you're above it, great. If you're below it, not so great.*
>
> *EMRs are, among other things, an attempt to define that cutoff while still allowing for enough variability to save those below the line. For millenia, doctors did the same thing at a personal level, making choices based on the patient they knew and the choices they made together. As medicine has become more capable, and expensive, it has become more difficult for physicians to make those distinctions, especially in light of the pressures arising from the costs being imposed upon society instead of borne by the individual.*
>
> *Our basic individual instincts as decent human beings causes us to rebel against selecting that set point at a societal level, but government and business have no such inconvenient moral imperatives. So the pressure is on - build EMRs - in order to allow entities lacking a conscience to make moral decisions*" #674 Hospital and healthcare professional.

5.4.5 Acceptability

Acceptability is an attribute that evaluates personal attitude and motivation for accepting EMR/EHR by its primary user - the clinician. Acceptability is affected by disturbance to workflows and increased workload, which include the patient-clinician encounter, documentation and interaction with others. Details of factors that have an impact on this attribute follow next.

Changes to clinical workflows and workload

Clinical workflows are argued to be the most problematic as they are unique and highly individualised. Each clinician has their own way of doing things and this is due to the autonomous nature of their work. Certainly, the less disruption caused to the workflow and better they are incorporated in the design, the higher the probability of intervention being accepted. However, many participants found that the practice to evaluate workflows prior to the implementation was not followed as it should, and in some cases such practice never took place:

> "*As an RN who works with many specialists, I felt it would be nice for the "users", MD's, RN, clerical staff to be part of the process long before implementation. I had hoped that someone, whether administration of potential venders could hear how*

each of our areas flow and function and show us what is out there to "better" our capabilities to better help our patients. As a professional in the specialty areas it is very important that we see what the PCP and others have evaluated, what medicines patients are on and what tests have been done" (#16) RN, surgery clinic

Clinical workflows, in addition to being individualised, are highly dynamic and ad-hoc, they emerge and change according to the situations encountered, where decisions made under such circumstances are solely that of the clinician and the EMR/EHR disturbs this setup as it tends to displace the *"dynamic BPM[13] or case management"* type of workflow with *"production workflow or BPM"*. In dynamic BPM workflows, doctors *"decide which activities are relevant to do in which situations. Or they decide when to do certain activities and in which order. It make no sense for the Doctors to wait for certain activities, when they judge them as irrelevant in their situation, or when they would rather decide to do them much earlier (e.g. performing some special testing based on the patient current medical condition & diagnosis). In the case management type of pattern, its human/doctors are in the driving seat and not the system"*. The production BPM on the other hand, is a pattern *"where human workers are not in the driving seat. In this type or workflow pattern, processes are well defined in terms of sequential tasks, i.e. "do task 1 and then task 2". In this pattern, work is executed sequentially. This aspects of process management Doctors like the least"* #152 IT strategist and enterprise architect.

In addition, workflows have a socio-cultural dimension related to the patient-clinician encounter that seem to be lost through the integration of the EMR/EHR, and vendors seem not to be sensitive enough to capture such dimensions. As stated by an EMR consultant when a physician expressed his concern that:

"the patient is always looking at my back during an encounter. I told him so turn your desk/chair around and look at your patient!" #611 EMR consultant.

Furthermore, different clinicians and their routines are affected differently due to the EMR/EHR implementation according to their job roles. From the clinicians' perspective the requirement to enter data does not only *"encroach on"* their time as they get *"irritated by*

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[13] BPM is abbreviation of Business Process Management.

having to hunt through scrolling menus or long sets of checkboxes in order to check off what they could have written in the time it took to move the mouse to the scroll bar" (#596 Hospital and healthcare professional) and increases their already stretched workload, but also reduces them to data entry clerks. This notion is reflected upon by a nurse:

> "*From a nursing perspective the problem is compounded by constant interruptions-procedures, telephone calls waiting, MD demanding attention, MD orders needing processed/changed/noted, patient call lights, emergent issues, admissions, discharges, transfers, clinician consulting one another in the nurses' station/hallways, equipment issues, meetings, on and on... Think about working a 12.5 hour shift and you can't leave until your computerized charting is done*" #474, RN, Subject matter expert and business analyst

Even if acceptance is achieved, perhaps through mandating the adoption, physicians will circumnavigate by bringing "*other people into the workflow to compensate for the failures of the technology. It is already happening! Scribes following doctors around doing his documentation for him. Medical transcriptionists being brought back on site and given direct access to the EMR so that they can correct the poor quality of the information entered by the harried and rushed physicians*" #493 Director of HIS.

Mapping workflows into the design

It is argued that workflows are the least researched topic within EMR/EHR deployment despite being the backbone on which the application design is based. The cause for this is attributed to the highly individualised and ephemeral nature of workflows. It exposes many issues for software coders and vendors as a typical workflow might consist of "*100-200 steps and there might be 50 of them*" that need to be mapped. These workflows are not just clinical but administrative too, and capturing and versioning the workflow is tricky because, for example:

> "*Patient A is on workflow W1 at step 50 and we make a change to that workflow at steps 20 and 70. If the nature of the change at step 20 is to add several new data elements, then switching your patient from step 50 of W.1 to step 50 of W.2 will now fail at step 70 because the data needed at step 70 on W.2 will not have been collected*" #150 EHR managing director and president.

Even if workflow are mapped, there are "*black-holes*" left during the mapping procedure by the vendors and the procurers due to poor follow-up, for example when it comes to administrating medication:

> "*During the procedure, the nurse gives a small amount of backtable drugs but the majority of drug administration falls to the anesthesiologist. Medication software vendors rarely make this distinction and the people who make the decision on what medication software is purchased rarely do either*".

Similarly, during the "*Short 7 minute procedures; there is not one nurse on the face of this earth that is going to chart electronically that fast...its like working at McDonalds[14] when you have a line up of these types of cases*" #236 Healthcare IT consultant

However, in some instances, workflow assessment if done accurately that includes defining "*what the steps are, what the sequencing is, who should perform them, when, how and even in some cases why*" (#151 EHR managing director and president), can facilitate workload and job role alignment and have an impact on best practices enacted by the clinicians.

Thus, there are ways in which the disturbance can be mitigated and one of them is to include clinicians in the decision making process. Another way is to provide a product specialist to assess the clinicians' workflow and support needed.

5.4.6 Demand and Efficacy

This attribute was discerned at three levels; personal, organisational and societal. One of the most important reasons that resulted in undermining the value of EMR/EHR at personal and organisational level was lack of consensus between what the clinicians want and what the providers present. This was the general feeling amongst the participants and they argued that such discrepancy between the real need and the solution results from a number of contributing factors. Among such factors was: the hastened decision of an organisation to procure EMR/EHR; failing to gain buy-in from clinicians generally and particularly due to the rush and complexity of technology; and failure of vendors to promote the packages accurately or "*grab the mindshare of medical professionals*" #319 Hospital administrator.

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[14] A fast food company

In some instances, despite buy-in, getting the end-user, especially physicians, to agree on the design of workflows was the most daunting task and regarded as "*herding the cats*" by vendors. Owing to such instances, the EMR/EHR is reduced to "*just another desktop icon to contend with*" as "*just getting the blue lights flashing in the server room is not going to yield the outcomes expected by those on the delivery side*" #516 Medical Informatics, President and CEO.

Participants also questioned the organisational culture where focus on "*measuring and improving outcomes, remains more aligned to delivery of procedures and services*" #444 Business development and Strategic sales.

Furthermore, vendors were perceived not to be listening to the real needs of end-users:

> "*I am working on one installation right now from a big name company who is further backward in their way of doing things than many of the smaller systems that I have installed. They refuse to customize everyday templates, claims have to be batched and submitted manually, they could not figure out how to use the existing network fax so they installed 2 fax modems in the server, incoming faxes have to be manually inserted into patient charts as do scanned cards and documents, and I could go on and on and on about the short comings of this particular system. Not to mention that the contractor hired to install the new server connected it directly to the internet sans firewall because he stated that the support techs from India could not get a LogMeIn connection through the firewall. This is without a doubt the worst system I have ever been involved with. I came in after the initial install and the physicians are very mad that I told them that the system will cost more to make usable than starting from scratch with a workable system*" #540 EMR services, Founder and owner

In addition, some argued that the real value of EMR/EHR was lost as clinicians perceive it as a tool to facilitate billing and thus used it as an administration tool or a back office tool to standardise care rather than as an application that provides better care delivery such as Picture Archiving and Communication System (PACS):

> "*EHR/EMR is a significant outlay of cash for something that is not directly a medical product. EHR/EMR is not treating patients, it is not a Swan-Ganz catheter that*

facilitates understanding a patient's physiology, but rather it is something more easily understood as administrative, and thus not a conventional priority" #6 IT and economics expert

and:

"*If the documentation is intended to tie the work to the billing (i.e. is not intended, or is only secondarily intended) to improve the quality of the work itself), then do we have an Electronic Medical Record, or an Electronic Insurance Record? Those would be dramatically different beasts*" #665 hospital and healthcare professional.

Some commented that such a belief was short-sighted and did not recognise the capability of these applications as decision support tools and how they might evolve:

"*Standard of care" is not "lack of choices" it simply means that there's a clear history for most patients of the path they travelled through the system, and given the path, the most optimal thing to do next. Say you've tried NSAIDs for arthritis pain, that didn't work, you are then prescribed a DMARD, but you're allergic to one and another is ineffective. Which other DMARD should you get? Should you go to a biologic next? And so on. Decision path like this should be standard, with a freedom of choice to deviate from a standard path with explanation of reasons. Given enough deviations and tangential successes, the standard model improves and self-corrects*" and "*Think of a MUUUCH larger curve - the evolution of healthcare in general. How many have died for the use of soap as a STANDARD medical practice? What about those that died so that we can standardize CPR training? defibrilators in IC units? etc etc. Now that technology permits it, and neural networks and other artificial intelligence technologies allow for extremely accurate evidence based decision support, why not have a standard of care process based on collective intelligence? Instead of your doctor reading a book that helped him save your life, and mine never even hearing about it and so I die. To the point of this thread, EHR is a way there, but it's flawed and must iteratively evolve before it becomes the tool we need it to be to allow real insight and intelligence that will save lives*"[15] #669 Enterprise architect

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[15] In this comment, NSAIDs stands for Non-steriodal anti-inflammatory drugs, DMARD stands for Disease-modifying antirheumatic drugs, and CPR stands for Cardiopulmonary resuscitation.

Such perceptions that recognise EMR/EHR only as a tool for insurance management might hamper how organisations benefit from EMR/EHR applications. Some state that awareness needs building up and care should be taken such that it is not compromised during initial trials and experiences.

Furthermore, such perceptions were fuelled through "*productivity sapping*" and loss of income during implementation. Hence, the EMR/EHR was seen as a cost centre rather than a revenue centre. This was particularly significant in the case of small scale physician practices that could not bear the task of EMR/EHR implementation and risk going out of business. The return on investment was not evident for a long period of time and was often not considered sufficient.

At a societal level, there was perceived lack of scientific evidence on the benefit of these applications for care delivery, and this was worsened due to the lack of co-ordination, and communication, not just between the vendors and procurers, but also between different organisations. Participants argued that there is no knowledge sharing on EMR/EHR implementation and it seems that each organisation is waiting for the other to be the first to experiment. If exemplars on transition during implementation and the utility of the application are provided, shared and discussed, then perceptions of clinicians who are the prime users can be changed. Moreover, not all accepted the rigour of the evidence, and were sceptical. They questioned its authenticity and suggested external interference in order to influence evidence reporting:

> "*one must be careful to discern whether this is good science or simply an attempt at sociopolitical engineering masquerading as science. The XYZ provided no link, which raises the suspicion that the study, the article, or both, could fall into the latter category.*
>
> *That is the accusation which has been made against the global warming community - global warming appears to be real, but the pro global warming scientists involved in the email scandal have been accused of attempting to distort the public perception of the data even more strongly in their favor. Likewise, the UN's WHO Report on the dangers of second hand smoke, which is based on unfounded assumptions and blatant overgeneralizations, has been a clear (and clearly successful) effort to turn public*

opinion against smoking, despite the virtual absence of data in the underlying science to support it's premise.

Once the combination of gov't policy and enormous amounts of public and private money enter the picture, as is the case in HIT, it is not much of a stretch to imagine that the study reported by (XYZ) could fit the same mold. Be careful out there" #508 Hospital and healthcare professional

Importantly, the EMR/EHR is expected to fulfil the diverse needs of many stakeholders:

"*...a good clinical information system (EMR/EHR) is going to house data that benefits all parties...1) patients, because it is easily accessible by all healthcare providers, 2)clinicians, because along with guiding the documentation process it aides in following best practices, 3) management, because it collects the efforts at the bedside to identify the work effort to provide care and 4) the business office, to get claims paid without delays*" #666, RN, Emergency room case manager.

However, in attempting to meet the demands of everyone, the applications often fall short of accomplishing the goal as "*one glove does not fit all*" #748 CEO, Corporate activities, Business and marketing.

Furthermore, end-users often do not know how to articulate what is required, nor differentiate between the design requirements and information needed:

"*I had an interesting exchange with an end user; it seems that some favorite screens were going to be taken away in an upgrade. The users were busy mourning the loss of the screens, not the information contained behind the screens My suggestion? Find out where else the information resided and perhaps they'd find that losing their "screens" might be a good thing!*" #484 Nutrition information consultant.

The same misconception also applies to the amount of data required:

"I *have also witnessed the end-user insisting that the new additional data is necessary. Many times the end-user does not realize that this requires increased data input for collection*" #483 IT manager.

Thus, the non-alignment of real needs versus perceived needs interferes with achieving the meaningful use of the EMR/EHR application, which should allow its end users to understand the process, purpose, policy and practice. Currently it does not and therefore, loses the value.

Also, demand and value can be severely compromised due to the design of EMR/EHR and in itself can be considered as a double edged sword. On one hand it can promise to deliver a customised package to fulfil the needs and demands of the end-user, which includes interoperability, data capture, data transfer and data storage. On the other hand, incorporating these functionalities can cause an application to seem cumbersome and therefore complex, but by omitting some of them might render an application as non-complaint and basic. From a participant's view, it is interesting to note how complicated and sometimes unrealistic the needs of the end-user might be:

> "*can you give me a software that will allow me to enter my patient summary with one click (!!!) and then at the same time, all my orders are placed, the software is able to apply the NLP to this piece of information that I have entered with one click, and the pharmacist knows what medication needs to be dispensed (after the software has applied and checked with the linked drug database, if there are no interactions with the ordered labs and radiology investigations....) and also by the way the system should be able to PRINT out that discharge/visit summary for the patient and send automatically the record to the insurance company to verify if I should treat this patient the next time, and oh I forgot to mention please ensure the system checks if this patient has had any payments to be pending from the last visit, and also check if the coding that I am doing will allow me to have the reimbursement from the insurance company, and oh don't forget that SNOMED and ICD 10 capability to convert all that I have recorded with one CLICK with the relevant codes for CPT, which should be linked with the health language engine that will be tied obviously with the NLP, and......please ensure all this happens within 3secs, else I would have to penalise you for the delays caused to the doctors as they are loosing out on our revenue, and because they are loosing out we are loosing out....and therefore I cannot pay you for the software that you are giving me that means you should ensure that I*

have all this on day one of conversion and go live.....else there will be penalty"[16] #364 Product Development Manager

In addition, political motivation was seen to be a factor that influenced the demand:

"*government gave the directive to healthcare software vendors to go forth and sell. There is not a clearly defined strategy nor a clearly defined problem to be remedied by installing EMR software*" #657, IT manager.

It was further added that government assistance was directed to some organisation and not others in ways not perceived, as for example, the quote below explains:

"*Today, $20M dollars in Federal money was unveiled, to be given to the rural hospitals/clinics. What a paltry amount of money. The small hospitals and clinics in rural XYZ need the most help from Uncle Sam. But they don't bring in the large voter turnout, nor donate the large amounts of money to political campaigns that it takes to win*" #670, IT manager

In addition, patient perception is evident through comments of the participants in these discussions. Generally, the comments described patients having little or no perception of the value of the EMR/EHR. Where there was a sense of value, issues such as incorrect or incomplete information and issues related to privacy undermined it:

"*The use of EMRs presents information privacy and security risks, which without clarity around the value, can be intimidating to patients*", and "*If the health care provider comes into the room with a laptop and the EMR data is missing or incorrect, the patient will not see the value*" #664 Privacy analyst (risk assessment)

5.4.7 Expertise
Introducing a complex automation such as EMR/EHR marginalises clinicians' expertise in various modes due to multiple reasons. These include change in skill set, unfamiliarity with modern technology or digital divide and changes in the clinical encounter.

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[16] SNOMDE is an abbreviation for Systematized Nomenclature of Medicine, in other words, computerised medical terminology. NLP on the other hand represents Natural language processing, and CPT represents Current procedural terminology.

One participant notes that nurses and doctors are not "*equipped or trained to deploy this complex automation*" (#7, Healthcare practice leader and founder), yet they are expected to use it without encountering any problems and instantly accept it within their work routine.

Many participants argued that expertise was affected due to a change in the set of skills required, not only to operationalise the application provided, but effectively incorporate it into working practice. These skills were to be learned and brushed up during the training sessions. However, training provided by the vendor was criticised as being inadequate, irrelevant, too short, and in some instances, not provided at all. One participant describes how the situation seems like:

> "*This is similar to purchasing an airplane when you've never flown before. Suppose salesperson gives you a manual, the keys and sends you on your way – no, there are regulations against that; but, there are no regulations or licensing required for EMR vendors. I want to make sure I know how to fly the airplane before taking off* " #592, Managing director, healthcare information.

Another participant reflected on how inadequately prepared some organisations were while deciding to get their staff trained which weakened the foundations of IS deployment efforts:

> "*I have implemented and trained while offices were still in construction (whose idea was that), inadequate training facilities and space cause impaired learning, but companies want to hurry up and get it done*" #191 Strategic implementation, Project manager

Such instances of poor training and the challenge to learn new skills caused one participant to emphasise the importance of end-user training and learning by saying that "*people didn't just jump into Henry Ford's iron horse and start driving down the street. No matter how educated they were*" #37 CEO of private company providing EMR/HER solutions.

Moreover, even after initial provision of training, clinicians often needed to learn again due to change/updates in application features or because they had forgotten how to use it due to a "*piecemeal*" style of implementation. This further elongates the learning curve.

Also, the trend in technological applications changes so quickly that at times it is hard to cope with pace of the change, and it unintentionally creates a digital divide among the newer and older clinicians, as expressed by a project manager involved in implementation:

"*I have seen physicians and clinicians do amazing things on their ipads and even develop their own databases to physicians who type with two fingers and clinicians who have never sent an email*" #719, and "*some doctors still dictate on a tape and hand it to their secretary to type in a chart note that is neatly put in a folder and filed in a cabinet. They will do that until the day they retire. Some newer doctors want to integrate their EEG/EMG technology and share reports within a hospital network. Different generations have varying views about technology*" #123 Attorney-Federal Law Practice.

In addition, participants acknowledged that medical training provided to medical students is also changing with time as recent evidence suggested that:

"*90%+ (of these students) stated that practicing medicine in these days and times cannot be done without the assistance of technology. Understanding they are naive to the field, they still are aware of the need for more technology in their work and running a successful practice*" #360 Director of Sales

Furthermore, during the clinical encounter, clinicians are trained to trust their own decisions as they are responsible for their patients and therefore, some oppose the decision making capabilities of EMR/EHR. They argue that these applications dictate the clinician-patient relationship and at times, these capabilities cause problems such as sidelining the intuition of the clinician due to the use of preformatted template. Hence, computers should not aim to displace human decision, rather to facilitate it as doctors are expected to have the ultimate decision for the patient even if is counter to advice:

"*if we look at a drug/drug interaction problem, it is easy to say that if we see the possibility of a negative outcome, don't mix drugs. But sometimes the benefit of mixing the drugs is worth the risk of the negative outcome. And if the negative outcome is certain, but not immediate death, plans can be made to treat that, in order to gain the benefit. I know; GOOD EMR's SHOULD capture documentation and*

contain overrides, so this should still be a physician's call, and not implicate the user as a bad practitioner"#392 MD[17], senior medical consultant

The clinical encounter is very complex, highly individualised, emergent and according to one nurse:

"If you take a billion separate little entrepreneurial businesses and tried to figure out a billion customer interactions you'd be on target for what you are up against in figuring out the Doctor/Patient interaction." (#157 RN, Senior consultant and project management).

Such an inherent complexity within the clinical encounter is attributed not only to physicians but also to the patients and can be understood in terms of the physicians' nature and patient variability as explained below:

"each Physician, whether in a Physician group or alone, is a separate /professional/business entity and think independently. No one Doc has the same Doctor/Patient interaction"#157 RN, senior consultant and project management;

And similarly,

"patient variability is explained in terms of *Human health (which)is, for all intents and purposes, infinitely complex. Each of us has over 100,000 genes, and almost every one of those can vary to some extent. Some, such as those which support the immune system, are enormously variable because there is a biological advantage, evolved over hundreds of thousands of years, to that. Imagine that Intel was trying to design your basic PC motherboard, but every piece of every component on the motherboard was subject to some arbitrary range of variability, which could not be predicted nor controlled for. In some cases, the right combination of parts would create a powerful, reliable mobo. In others, the mobo would function, but erratically, unreliably, and only with continuing care and maintenance."* #674 Hospital and healthcare professional

In addition, involvement of scribes during the clinical encounter can be perceived as a threat to privacy that is shared between the doctor and patient. Scribes are healthcare professionals

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[17] MD stands for doctor of medicine

who follow doctors. While the doctors tend to their patients and enact the clinical encounter, scribes enter the information into the EMR/EHR. Figure 14, shows a scribe with a clinician in an emergency ward.

Figure 14: Scribe taking notes from doctor (source: http://articles.latimes.com/2010/sep/06/health/la-he-medical-scribes-20100906)

Also, dictating in front of the patient to either the Scribe or into the computer is seen as inappropriate. In some instances the physicians would leave the examining room to capture the data and then return to continue and conclude the encounter with the patient. This is not least because the information to be entered was confidential and the patient has a full right to access to whatever is included in their EMR/HER. A similar perception can be fostered in regards to medical transcriptionists, not in terms of privacy but undermining physician's skills and losing the "*once and done*" effect of documentation as explained by the director of Healthcare Information Systems (HIS):

> "*now, rather than a doctor dictating, a medical transcriptionist either typing or editing speech recognized draft text, the physician reviewing and signing off, they now have the physician creating the documentation, a medical transcriptionist reviewing what the physician entered, then the physician having to review AGAIN before signing off*" # 577

Expertise is also affected due to the issue of status quo and power and it is occasioned in two ways. Firstly, by redefining the job role. In many instances, physicians get nurses to do the

data entry as they see the EMR/EHR reducing them to data entry clerks. In their perception, their prime duty is to deliver care to the sick and not entering the data. The task of data entry is also contended as an added workload to an already overstretched schedule and some argue that this makes *"the most expensive person in the loop the creator of the documentation, instead of the provider of the information. And they've made the medical transcriptionist the keeper of the quality"* # IT manager.

Secondly, by introducing superiority or inferiority complex. On one hand, bringing medical transcriptions and scribes might be seen as undermining one's ability to multitask and use computers and termed as *"tech-aversed"* #125 Software developer, whilst on the other hand *"the clinician is no longer the repository of knowledge and decision making (even though I wish they were) ...the database and the best practice algorithm dispense knowledge and decisions"* #758 HIS Project Manager.

5.4.8 Interaction
Introduction of the EMR/EHR is perceived as having the most significant bearing on the patient-clinician encounter.

The EMR/EHR introduces a change in the way the information is captured during the clinical encounter. With the new setup, clinicians type in the information within the consultation. Hence, physicians may spend more time on entering the information than attending to their patients. This provokes some physicians to either allocate these duties to nurses or other staff, or not do it at all and reject the technology:

> *"It takes ......almost 20 minutes to type the information in EHR. They hardly spend 10 to 15 minutes with each patient. Most of the EHR work is done after hours – sometimes by the physicians themselves but mostly by nurses"* #359, Chief strategy officer

As highlighted by the quote above, the workload is transferred to nurses and in turn has an impact on their interaction with patients.

Furthermore, the EMR/EHR and its design features are accused of taking the subjectiveness away from the clinical notes due their design as templates. It's almost the scenario where

literally, sometimes, the patients are "lost in translation" and instead represented through graphs and charts, as evident from the quote:

> "*Humans think in stories. We communicate in story form. We problem-solve using stories. We cannot turn millions of years of evolution on its head and expect clinicians to suddenly think ONLY in terms of graphs, charts, and canned phrases……Why is one diabetic patient treated with a different regimen than three other patients seen that same day? The answer is NOT in the canned text of the pull-down menus. The answer can't be teased out of pages and pages of "negatives" The answer is in the NARRATIVE*" #514 Technology consultant.

Thus, use of the EMR/EHR interferes with the clinical encounter through the mode of data capturing. The participants' debated on the suitability of structured and unstructured data and time seemed to indicate that during the doctor-patient interaction, doctors preferred to narrate the encounter as a story, as it provided a holistic picture than to use preformatted templates:

> "*EMRs inherently work in the opposite fashion. The goal of the EMR, as designed, is to gather all the demographic information and documentation that will support the one true diagnosis, which is intended to be selected by the physician prior to the end of the encounter. But physicians, when faced with the demand of the EMR to make that solid commitment to a specific diagnosis, become uneasy. It may be (and probably is) subconscious, but all our training and our practice habits have been directed towards arriving at a diagnosis based not only on what the problem appears to be, but also on what we have done to make sure it isn't something else that appears similarly. Making, and committing to posterity (and the courts), a rigid diagnosis with no wriggle room just goes against the grain of what we do.*" #872 Hospital and healthcare professional

Clinicians find this absence of subjectivism annoying and are forced to ask the patients about their medical history to get the holistic picture. This shifts the balance of power towards the patient who is now seen as more of an expert on their health than the clinicians they are visiting. However, such a shift can sometimes be the cause of more harm than good as patients "*toting their medical records around, or telling their story over and over again*

during their sickest moments" (#458, RN, Subject matter expert and business analyst) might not be able to recall each and every detail correctly.

Also, the autonomy and almost complete discretion in making decisions that comes as a bonus due to (the status quo of) being a clinicians, is suddenly threatened due to the decision support capability of the EMR/EHR and the inherent characteristic of keeping an audit of events, in essence a surveillance capability. Clinicians, although against these features of an application, take steps to safeguard themselves while making a clinical decision affecting patients. Hence, a change in interaction between patient and clinician is influenced by the design features of an application. In addition, the appointment of scribes and medical transcriptionists to enter data during the encounter and check the quality of data entered further induces the sense of technological panopticon:

> "*I think the problem in most of the current EMR/EHR systems are that knowledge is not combined within the processes/workflows. The healthcare processes are in nature very dynamic & ad-hoc. For example, Doctors can decide based on the current condition of a patient for a blood test or not. Doctor can run a test on a patient that could lead to a treatment plan. This treatment plan can be monitored that may leads to additional testing..which may lead to a modified treatment plan.. which is again monitored. This example describes that the process of patient admission & check up can be very ad-hoc, dynamic and emergent. It is the Doctor, the knowledge worker, who decides the right course of action.*" #144, IT strategist and enterprise architecture

5.4.9 Trust

The notion of trust is used by participants to convey the feeling of being assured that their actions and the other person's actions with whom they are interacting, will cause no harm. This mindset can be extrapolated to interaction with IS innovation, and the contextual setting under which the interaction takes place. Trust in this study encompasses technology trust, interpersonal trust, organisational trust and inter-organisational trust.

Technology trust

Various features, internal and external to technology are perceived harmful in several different forms and therefore constitute a potential threat to the trust invested. Primarily, unintentional use of the technology in a way that might harm the patient or compromise

patient safety and put them at risk is a factor that might impinge on the technology trust, an instance of which the quote below highlights and portrays how easily this can take place:

> "*they (physicians) substitute canned text for actual thought processes and end up with contradictory statements like "No history of sexually transmitted disease" in one section of the report, and "status post c-section for active HSV" in another section of the report*" (#805, Technology consultant)

Making grammatical mistakes in reports such as "*the patient will have hysterectomy or did have hysterectomy—tense matters!*" (#798, Technology consultant). In addition, participants discussed an instance where a physician using "*pull forward*" feature "*had comments like "incision healing well, stitches removed" in 4 consecutive reports following a surgery that was dated 1 year previous*" (#805, Technology consultant), and failed to edit the entry as he did not use the feature appropriately. Such instances are becoming a common occurrence and have an impact on the interpersonal trust between the physicians, patients and other professional involved in the process of delivering care, including scribes and medical transcriptionists, as "*If data was incorrectly entered, another user visiting the EHR may not see that a correction was made subsequently and if they rely on the incorrect entry, there can be serious consequences*" #150 Managing director and president of EMR/EHR solution company.

Furthermore, an inability to access the EMR/EHR might pose a risk to the patient's health for example:

> "*say a patient with cancer is coming in for his/her monthly radiation treatment. If the hospital has implemented EMR and there is a server downtime or EMR fails to load due to software crash etc, accessing the patient data becomes thorny, which will greatly affect the patient care*" #59, Business development executive

Technology trust is also affected by the evidence of technology usability and the way it is advertised by the vendors. It can be inferred from the quote below how vendors often succeed in getting users hyped-up by using fancy names for commonly available applications:

> "*The uniqueness of the many available solutions stems from the fact that the term "EMR" lumps together too many systems of wildly different intended uses. It's akin to*

putting SAP, MS Windows and Oracle together into a single category and calling it "Corporate Computing Solutions"” #549 hospital and healthcare professional

Interpersonal trust

Patterns of trust develop over time, and these are displaced due to healthcare-IS deployment, especially if one is trained to not invest trust easily, either in others or in the technology:

“*Physicians, the driving force of the EMR/EHR use, are the least knowledgeable when it comes to IT; not because they are stupid, but because of inherent personalities that are reinforced by medical education. The physician is conditioned to trust only him/her self because he/she is solely responsible for the patient (ultimately the life) in their care. Lab tests are never blindly trusted; even referred to physicians (specialties) are only trusted when he/she is responsible for direct treatment*” #374, MD, Senior medical consultant

Interpersonal trust is to some degree influenced negatively by employing medical transcriptionists who rewrite physicians' notes and reports. Some of these notes, at instances as described below, are clearly not efficiently written and MT's claim that they “*have been protecting doctors from themselves*” #805 Technology consultant.

For example: as written by a physician:

“*14 wm presents with a possible. wound infection. the right knee was opened up with sdliding into a base. iNITIALLY IT was 2 weeks ago. This AM there were pustules that developed this AM. There is redness surrounding the wound. there is no real pain with the infection.*”

And as written by medical transcriptionist:

“*This is a 14-year-old white male with a possible wound infection. The right knee was opened up 2 weeks ago when he slid into a base. Pustules developed this morning. There is redness surrounding the wound. There is no real pain with the infection.*” #687 Technology consultant

Organisational trust

As one of the initial aims behind EMR/EHR design was to collect data for billing and litigation issues, its perceived image as a surveillance tool cannot be contested. Many

clinicians argue that delivering care is complex and requires taking individual ad-hoc decisions, which are often worked out autonomously. Applications such as EMR/EHR impose the feeling of being constantly monitored "*like in big brother*" and contributes towards being counterproductive. Furthermore it is perceived to be driven by the "*assumptions that doctors and nurses are a) incompetent and b) cheaters drives the demand for documentation, not any sort of well intended need for additional information. The vast majority of documentation required is completely pointless from the perspective of providing quality health care, but instead serves only to drive profits for those who provide for (insurers, via reduced costs) or prey upon (attorneys, via increased evidence) those who would help us remain healthy*" #675 Hospital and healthcare professional.

The number of stakeholders further complicates the issue as voices of some might get heard more often than others.

Intra-organisational trust

Where, on one hand clinicians question the real intention of the organisation in deploying EMR/EHR, on the other hand, the procurer within the organisation questions the trustworthiness of the vendors. This was especially the case when vendors advertised free software. Such vendors were called "*shameless*" and condemned for ripping off their clients by charging enormously for training and upgrades. Other issues that contributed to breach of trust from this dimension included misleading the procurer on the actual duration of deliverables, providing software packages that lacked user specified requirements and some even suggested that bribery was a common phenomenon that allowed some vendors to win the bid as they "*wined and dined*" powerful people from the procurer side (#99 Infrastructure architect). Such an attitude by vendors led to fostering strong dislike as evident from the quote:

> "*The vendors that are poisoning the industry are costing customers too much money and trust, and the rest of us are being affected by their actions. Many of the problems in the software industry, particularly bloated, buggy, and insecure software, are a direct result of the business models that foster stagnancy and inertia rather than innovation and value*" #612 RN, Emergency room case manager

Experts argued that instances of "*botched*" implementations were often due to misalignment in interests of the vendors and procurers, and led to spread of mistrust within the medical community against vendors as expressed in the quote:

> "*I believe that once that sense of distrust permeates a community, it's very difficult to overcome. Health care providers and administrators are a community and as in all communities word spreads and evolves quickly. I can understand these less tangible reasons why providers are leery to reinvest when in their opinion the HIT delivery community is unwilling to be forthright about expectations*" #990, Quality assurance analyst.

However, an interesting notion shared by many experts was that the vendor size certainly had an impact on the trustworthiness, as small scale vendors were reported to be slightly more trustworthy than the large scale vendors. This correlation was often established in terms of commitment that a vendor would provide before and after the implementation versus the value delivered and the overhead of that company.

> "*Large companies need to make more money just to feed the beast, and many of them also have a stock price or dividends to worry about too, as well as the need to build cash reserves for M/A actions. This does not mean that small software companies are perfect or never take advantage of their customers; it just means that bigger companies have a lot more urgency to wring every last dime out of their customers*" #612 RN, Emergency room case manager

5.5 Discussion

In this chapter, the transferability of the Triality framework was evaluated using data from online discussion forums. Although, subject to being contested due to methodological remit, data from online discussion forum proved to be valuable in this study in more than one aspect. It allowed gaining an understanding of very different healthcare system in U.S.A as compared to NHS in the U.K., and that which faced similar IS deployment problems. This method also enabled drawing out additional ways in which the nine attributes of the framework are articulated, and by extrapolating these findings, it also facilitated

understanding how attributes interrelate to each other. These are discussed in the following two sections.

5.5.1 Processes of attribute articulation

Design

The design of EMR/EHR is iterative in nature as it is scalable according to the requirements of its users. It may be customised according to work practices (also termed work flow) or can be assembled using off the shelf components. However, such an iterative nature causes conflicts due to involvement of various stakeholders and their interests in using the application for different purpose (Boonstra and Broekhuis 2010, Greenhalgh et al. 2010, Balka 2003), and deciding on features of interoperability, data capture, data extraction and storage that outline whether the application would function as EMR or EHR (Garets and Davis 2006).

Design was further affected due to vendors as they sold applications that did not match the specification and were not fit for the purpose. This amounted to delays in the deployment process.

Efficiency and effectiveness

It was noticed that in this attribute, efficiency was the most discussed aspect. Participants argued that EMR/EHR applications decreased efficiency due to poor design (Jensen, Aanestad 2007b, Jensen, Aanestad 2007a), which in turn resulted due to customisation versus standardisation debate between the vendors and procurers.

In addition, efficiency was impacted due to time invested in learning new skills (Jones 2003), assessing the clinical needs of the system, and lack of provision of support such as provision of scribes.

Optimality and equity

Pertaining to this attribute the debate mainly concerned optimality and was argued to be impacted by evidence and benefits of using EMR/EHR as a clinical tool. Equity however, in this case was not perceived as an issue as this innovation was not distributed directly to patients and neither were they its sole users.

Legitimacy

The debate that surrounded this attribute involved legislative and ethical implications. It was

argued that the various acts and laws governing the design of EMR/EHR applications were a cause of concern for many organisations and individual clinicians (PCAST 2010). In addition, in wake of meeting the requirements set by these laws, manufacturers tended to add many features to the application which made it complex. This added complexity also had ethical implications as clinicians perceived EMR/EHR as a tool that aimed at standardising care delivery through its decision aiding ability.

Acceptability

Acceptability was impacted due to deployment of EMR/EHR as it interfered with day-to-day clinical work and added new workload (Davidson 1997, Davidson, Chismar 2007, Jensen and Aanestad 2007a, Jensen, Kjærgaard and Svejvig 2009).

Demand and efficacy

Demand and efficacy of EMR/EHR was affected due to lack of perceived need and value of the innovation (Boonstra and Broekhuis 2010, Davidson 2006, Jones 2003, Davidson and Chismar 2007, Reardon and Davidson 2007a, 2007b, Greenhalgh et al. 2010, Davidson and Heslinga 2007, Davidson and Chiasson 2005). In addition, lack of knowledge sharing on EMR/EHR deployment and impact on outcomes in different organisations contributed to the lack of its value.

Expertise

Expertise was affected due to change in skills, training provided to use the EMR/EHR applications and support provided.

Interaction

Interaction between the clinician and patient changed due to changes in ways in which information was captured during the clinical encounter. It was argued that EMR/EHR shaped clinical encounter by providing a template of questions that were required to be asked and section that were required to be completed. This restricted subjective assessment and natural flow of conversation between the patient and clinician (May 2007).

Trust

Trust was breached at various levels (Zaheer, McEvily and Perrone et al. 1998, Timmons, Harrison-Paul, and Crosbie, 2008) due to EMR/EHR deployment. At technology level participants argued that the unintended use of such an application might cause harm to patient. At a personal level, it was argued that such applications impact the status quo of clinicians (Hendy et al. 2007, Hendy et al. 2005) and their instincts. At organisational level,

such applications were perceived as surveillance tool (Jensen and Aanestad 2007a, Timmons 2003, Walter and Lopez 2008), and at inter-organisational level; it was argued that the vendor and procurer made deals that were in favour of their personal gain.

5.5.2 Attribute interrelationship

The study revealed that the design attribute was the most dominant. It signified the importance of having the right product with the desired specifications and customized features. Participants within the study argued that poor design was frequently the cause of failure; with associated escalating costs and ultimately being abandoned. Participants commented that this was usually a result of discrepancy between the aims and goals of two separate parties, one interested to sell while the other interested to buy and deliver care.

Such a conflict between vendors, buyers and user affected trust at various levels (Reardon and Davidson 2007b), and can be argued to stem from impact on choice, sense of control, and therefore can be undermined by ethical reasons (legitimacy) and is governed by compatibility of motives and decision making authority (expertise). This can be further understood by taking the argument that modernisation in healthcare has changed the relationship of trust between the care provider, care receiver and the context of care delivery (Calnan and Rowe 2006). For example, the traditional relationship between the patient and clinician was based on embodied trust under what is termed as paternalistic medicine and now this has changed to informed trust and the patient is now the informed patient. This is also presented in the case of relationship with peer and management (Rowe and Calnan 2006, Calnan and Rowe 2008). Peer trust based on self-regulation and hierarchy has moved to shared care and earned trust. Whereas, management autonomy and expertise have moved to clinical governance and performance.

The findings of study elucidate that both design and trust, affect the attribute of demand and efficacy, and therefore can be argued to have an impact on perceived needs of the system at organisational and individual level; and it is seen that healthcare professionals will only use the IS innovations that they felt were needed to facilitate care delivery (Davidson and Chismar 2007, Reardon and Davidson 2007b, and Shin 2010).

The attributes of legitimacy (comprising of ethics and legal rules) has an impact on all the other attributes as it is enacted as an ideological dimension of organisational politics (Kling and Iacono 1984). These dimensions become visible when IS innovations are implemented and used (Lankshear and Mason 2001).

It can also be argued that power plays a role in dictating the outcomes of ethical issues encompassed within legitimacy, as in some instances, issues raised by IS innovation can empower those over whom the control was intended (Doolin 2004). For example, although the HIPPA privacy rule and HITECH Act aim at safeguarding data and protecting privacy and therefore requires vendors to ensure that their products abide by these rules; many vendors use them instead as ways to promote their product, thus, exploiting the ambiguity and confusion over what constitutes HIPPA compliance (PCAST 2010)

In addition, it can be argued that trust, design and legitimacy influence and are also influenced by user expertise, their acceptability and the way they interact. Such influences can originate at different levels and examples include change in governance and policy at organisational level, and changes due to IS innovation in clinical routines, clinical encounter and familiarising with functionalities of the innovation at individual level (Baptista 2009).

The complex interrelationships through which various attributes interrelate to each other are tabulated in table 5.

Name of an attribute	Affects	Affected by
Expertise	Demand & Efficacy Acceptability Design Trust	Design Trust Legitimacy Interaction Pattern
Interaction	Trust Expertise Acceptability Design	Legitimacy Design
Trust	Demand & efficacy Expertise	Demand & Efficacy Acceptability Design Legitimacy Expertise Interaction pattern Optimality & Equity
Legitimacy	Demand & Efficacy Acceptability Design Trust Expertise Interaction pattern Optimality & Equity	
Acceptability	Design Trust	Demand & Efficacy legitimacy Design Expertise Interaction pattern Efficiency & effectiveness

Demand & Efficacy	Acceptability Design Trust Optimality & equity	legitimacy Design Expertise Trust Efficiency & effectiveness
Design	Demand & Efficacy Expertise Interaction pattern Efficiency & effectiveness Acceptability Trust Optimality &equity	Legitimacy Acceptability Demand & efficacy Expertise Interaction pattern
Efficiency & Effectiveness	Acceptability Demand & efficacy Expertise Optimality & equity	Design
Optimality &equity	Trust	Efficiency & effectiveness Design Legitimacy Demand and efficacy

Table 5: Breakdown of attribute interrelationships

5.6 Summary

In this chapter we investigated that complex IS innovation such as electronic records may cause variance in the significance of attributes, and the ways in which they are articulated. In addition, we also explained how such complexity fosters various interrelationships between the nine attributes.

Chapter6: Conclusions

This is the final chapter of this thesis, and starts by presenting the overall conclusions drawn by mapping the findings from two longitudinal case studies. The author then reflects on the research contribution to the field of IS and healthcare, in particular to e-health. This is followed by enlisting the implications and limitations of this research, and finally, a brief section on personal reflection concludes this chapter.

6.1 Overall conclusions

From a theoretical perspective, this research has sought to explain the complex relationship between the healthcare social system, the human agent and the IS innovation. The nature of this relationship is recursive. In addition, it explores the impact of this relationship on daily work practices of individuals, and identifies nine attributes through which the relationship and its impacts are articulated. These notions are assimilated in a conceptual framework called the Triality Framework.

From a practical perspective, this research employed the Triality Framework to enhance understanding of IS innovation deployment and evaluation efforts, and it emerged that there are very noticeable differences in the way in which the processes of IS innovation deployment and IS innovation evaluation are articulated, and how they impact the healthcare professionals and other stakeholders. These differences are briefly summarised as follow:

Processes related to deployment:

- Are lengthy, very disruptive and at times very slow. However, slow progress should not be regarded as failure.

- Are context specific. This is especially significant in the case of healthcare as it is a complex and constantly evolving field. This complexity is affected by the organisational setting that is said to have "*its own unique DNA*"; and encompasses its size , type, culture, and the current external environment.

- Involve many stakeholders, ranging from vendors, procurers that include management at all levels, users that include healthcare professionals, administrators and patients. It

is vital to acknowledge the views of all these stakeholders, as bypassing them might impinge on the success by leaving gaps in expectations, souring the relationships and violating trust.

Processes related to evaluation:

- Promote dilemmas pertaining to ethical and equitable distribution of health care services among healthcare professionals.

- The timing when evaluation is commenced has an impact on the assimilation of practice, such that if the evaluation is commenced too early, the service normalisation might never be achieved due to overburdening (workload); and on the other hand if commenced too late the service users might reject it or impose greater resistance.

In addition, the findings of research enabled identifying points pertaining to the Triality framework such that:

- All the attributes of Triality framework are transferable, and with wider set of data available, many more dynamics through which these attributes are articulated were identified.

- Not only does the process of deployment and evaluation have an impact on significance of attributes, but the nature of IS innovation has a similar impact. For example in case of the EMR/EHR, the attribute of design was most significant due to its iterative nature. However, such was not the case with regards to telehealth as its technological design is mature.

The findings of the research also enabled an assessment of how each attribute should be considered during IS innovation deployment and evaluation processes:

- Design includes the design of an IS the innovation and the design of the service of which the innovation is a part. The IS innovation design depends on what functions are required and whether the users are familiar with these functions. However, the number of stakeholders involved can delay the design process, not least because their views were not considered.

- Debate on efficiency was evident in both case studies and was enacted due to IS innovations and evaluation strategies. Effectiveness however, was mainly discussed in terms of RCT and only some points were discussed in relation to a telehealth. In case of electronic records, no comments on effectiveness were made. Healthcare professionals assess the effectiveness of an innovation in terms of the benefits it offers and the impact it is perceived to have upon the patient.

- Optimality was significantly questioned when evidence pertaining to the benefits of IS innovation was little or not available. On the other hand, aspect of equity was significant when IS innovation was to be distributed to patients and used by them. For example, in case of telehealth evaluation, RCT caused concern as to who will get telehealth equipment whereas in case of EMR/EHR study, such was not the case.

- Legitimacy is an attribute that can be argued to be most prominent in relation to IS innovation deployment and evaluation in healthcare. It can be argued that legislative requirements and standards play a vital role in assimilation of IS innovation such as EMR/EHR. Ethical implications on the other hand, arise due to complex set of rules associated with IS innovation design, deployment and evaluation. In addition, such ethical dilemma widens when evaluation strategies such as RCT are employed.

- One immediate impact of deploying or evaluating IS innovation is its impact on daily routines of human agent. In both case studies, healthcare professionals and clinicians argued that introducing new innovation added extra work and changed their current work practices, thus impacting acceptability.

- The demand and efficacy was impacted by users' perceived need and added value of the IS innovation. In both case studies, it was noticed that disseminating evidence and sharing successes stories contributed to the value and perceived demand of IS innovation.

- Expertise was impacted due to IS innovation deployment and evaluation. For

example, in case of telehealth, healthcare professionals had to familiarise themselves with RCT as well as telehealth. Participants argued that deployment of IS innovation required them to learn how to use the innovation. Expertise was marginalised due to inappropriate training and support provision.

- Interaction during clinical encounter is subject to change when IS innovation is deployed and evaluated. In case of telehealth the face-to-face interaction was changed to patient-innovation-nurse interaction. In case of RCT, the subject of interaction was patient assessment instead of discussing health issues that the patient suffered. In case the EMR/EHR the interaction changed due to information captured and the format in which it was captured during the clinical encounter.

- Trust was observed to be articulated through the processes of deployment and evaluation. These encompassed issues around patient safety, surveillance and compromise in quality of care by saving cost.

6.2 Research contributions

This research has sought to make theoretical, methodological and practical contributions.

Theoretical contributions of this research are:

- To present a conceptual framework called the Triality Framework. It uses three main theoretical perspectives which include Structuration theory (ST) and Consequences of Modernity (Giddens 1979, 1984, 1990) the technology-in-practice (Orlikowski 2000, 2002), and the contextual approach (Pettigrew 1985, 1987); and presents an argument that a 'recursive' relationship representing mutual interaction exists not only between two entities, but between all three interacting entities of context, content and the user. This interaction is enacted through various dynamics termed the attributes.

- This research was conducted in the field of healthcare which provides an ideal contextual setting for IS theories, where these can be explored and developed (Chiasson and Davidson 2004). Prior to this research, this has been done without considering telehealth and the electronic record as IS innovations, whose deployment and evaluation challenge the normality of healthcare delivery processes.

- This research bridges the gap between the field of IS and healthcare by reviewing theoretical approaches and concepts from both streams of literature. Besides using three prominent theories from IS, the attributes of the Triality Framework represent some of the concepts that have their origins in the fields other than IS.

- To determine the impact on healthcare professionals' work practices through application of the Triality framework. Furthermore, to investigate understanding telehealth and electronic records deployment as expert systems where trust is breached and expertise of healthcare professionals is challenged.

Methodological contribution of this research pertains to:

- Contributing to the field of qualitative research through the use of online discussion forums as a source of qualitative data. The use of discussion forums to understand IS innovation deployment and evaluation in the field of healthcare is believed to be previously unused approach. Guidelines on approach to this method and ethical considerations are presented.

Practical contributions of this research include:

- Using a Triality framework in this research provides an understanding on how assimilation and routinization of IS innovation and its evaluation strategies changes over time.

- Highlights how users' decisions on using and accepting IS innovation and its evaluation strategies is influenced by disturbance in their work practices. These disturbances are mediated through the nine attributes outlined in the framework.

- Informs how the complexity due to iterative nature of IS innovation such as in the case of electronic records, and the potential surveillance capability of IS innovation as in the case of telehealth, impact users' decision to use it.

- Using nine attributes of the Triality Framework to understand how a healthcare professional makes sense of the change introduced. In the process contributes to the

knowledge of change management.

- By application of the nine attributes and the dynamics of their articulation, informs all those involved in e-health deployment and evaluation how to improve their approach.

6.3 Implications of this research

There are many implication of this study and they are:

- This study is one of the first to have applied theoretical perspectives of Pettigrew (1985, 1987), Giddens (1979, 1984, 1990) and Orlikowski (1992, 2000) together with other concepts from healthcare literature to explore areas that are understudied in the field of IS. Furthermore, the enhanced conceptual framework provided greater richness through the multilevel and multi dimensional analysis offered.

- The findings of this research are based on two longitudinal case studies and using these studies, the research considered issues pertaining to telehealth deployment and evaluation and electronic records deployment. This was based on experience and explanations provided by various stakeholders from different contextual settings and countries. This therefore, should allow generalisation of some aspects of this study to be extrapolated to other countries or other stakeholders.

- This research focused on IS deployment and its evaluation initiatives, where the innovations in question included telehealth and EMR/EHR; and provides a timely insight on how the deployment efforts and evaluation efforts should be managed as they both influence various stakeholders in different ways; and how a qualitative research applying recursive approach within IS can benefit from perspectives based on theories originating from different fields

- This study also considers how user interaction with IS innovation over time, impacts their perception.

6.4 The limitations of this study and future research

This study has some limitations, which are:

- In the telehealth case study, the pre- and post implementation phase of a relatively

small scale service and limited number staff involved meant that only few of them participated in the focus group discussions and interviews.

- The telehealth case study only explores telehealth and case management as a healthcare delivery service for patients with chronic conditions, and has limited perspective with regards to other models of telemedicine service delivery such as radiology or dermatology.

- In case of electronic record case study, this research used pre-established and active discussion thread available in particular domain. Establishing dedicated discussion thread in desired domain (healthcare websites), with time limits specifying start and end dates, has a potential to overcome issues around data saturation and ethical dilemmas such as consenting. Future research could consider where and how could this be achieved.

- This research uses the qualitative data analysis method. However, using a quantitative data analysis method that involves statistical analysis would have enabled evaluating the strength of relationships between the attributes and express them as dependencies. Future research could consider how this might be achieved.

- This research considers the view of many of the stakeholders associated with introduction of IS innovation, but focuses on primary users. It does not consider any of the perspectives of the patient or their views. Future research could consider how to include the views of patients, whether these influence outcome, and how these compare to the perceptions of other stakeholders.

6.5 Summary

This research has documented that to understand IS innovation deployment and evaluation processes in healthcare, it is important to consider that the IS innovation, the healthcare context and the user are interrelated to each through recursive relationship. This relationship is articulated through nine attributes that impact the use of IS innovation in daily work practice.

6.6 Post Script

When I started this research, I was unaware of its implications on my personality, the way of thinking, and of course, my behaviour in general. There was a more pressing reason to finish this PhD than to start it. This was my promise to my mum. I had wanted to graduate in 2011 so that my mum could attend the ceremony. Sadly however, I lost her in May 2011. This created a void in my life and understanding of it. Suddenly I started to question everything I was doing.

This strange sense enabled me to audit my own work. It somehow detached me from the ideas that seemed to clutter my understanding. It made me aware of what that had to be done and what had to be dropped. Completing this thesis was thus one the things that had to be done and therefore made easier as I no longer attached myself to the concepts that I once thought were salient. The implication was that I finally finished writing up.

By going through the experience, I developed a deeper sense of appreciation towards the work of others and was influenced by their achievements despite struggles in their life, and in particular, Donabedein's personal saga touched my heart. I realised that research is not just a journey towards gaining an academic stature, but a journey deep within, that questions and tests your values, morals, strength, principles and above all, it asks whether it's worth it?

References

ADAIR, C.E., MARCOUX, G., WILLIAMS, A. and REIMER, M., 2006. The Internet as a source of data to support the development of a quality-of-life measure for eating disorders. *Qualitative health research,* 16, pp. 538-546.

AMMENWERTH, E., GRÄBER, S., HERRMANN, G., BÜRKLE, T. and KÖNIG, J., 2003. Evaluation of health information systems - Problems and challenges. *International journal of medical informatics,* 71, pp. 125-135.

ANDERSON, J. G., 2007. Social, Ethical and Legal Barriers to E-health. I*nternational Journal of Medical Informatics*, 76, pp. 480-483.

ANDERSON, J. G., and AYDIN, E. C., 2005. *Evaluating the organisational impact of healthcare information systems*. 2nd edn. USA, Springer.

ARMSTRONG, D., 2006. Evaluation as an Innovative Health Technology. In: A. WEBSTER, ed, *New Technologies in Health Care: Challenge, Change and Innovation.* Palgrave Macmillan.

AVGEROU, C., 2002. *Information Systems and Global Diversity.* 1 edn. USA: Oxford University Press Inc.

AVGEROU, C., 2001. The significance of context in information systems and organizational change [Online]. *LSE Research Online*.

AVGEROU, C. and MADON, S., 2004. Framing IS studies: understanding the social context of IS innovation. In: C. AVGEROU, C. CIBORRA and F. LAND, eds, *The Social Study of Information and Communication Technology Innovation, Actors, and Contexts.* 1 edn. New York: Oxford University Press, pp. 162-182.

BALKA, E., 2003. Getting the Big Picture: The Macro-Politics of Information System Development (and Failure) in a Canadian Hospital. *Methods of information in medicine,* 42, pp. 324-330.

BANNISTER, F., and REMENYI, D., 2003. The Societal Value of ICT: First Steps Towards an Evaluation Framework. *Electronic Journal of Information Systems Evaluation*, 6, pp. 197-206

BAPTISTA, J., 2009. Institutionalisation as a process of interplay between technology and its organisational context of use. *Journal of Information Technology,* 24, pp. 305-319.

BARBER, N., CORNFORD, T., and KLECUN, E., 2007. Qualitative evaluation of an electronic prescribing and administration system. Quality & safety in health care, 16, pp.271-278.

BARBOUR, R., 2007. *Doing focus groups.* London: Sage.

BARDRAM, J.E., BOSSEN, C. and THOMSEN, A., 2005. Designing for transformations in collaboration: a study of the deployment of homecare technology, *In Proceedings of the 2005 international ACM SIGGROUP conference on Supporting group work (GROUP '05),* ACM, New York, US, pp. 294-303.

BARLEY, S. R., 1990. IMAGES OF IMAGING: NOTES ON DOING LONGITUDINAL FIELD WORK. *Organization Science,* 1, pp. 222-247.

BARLEY, S. R., 1986. Technology as an Occasion for Structuring: Evidence from Observations of CT Scanners and the Social Order of Radiology Departments. *Administrative Science Quarterly,* 31, pp. 78-108.

BARLEY, S.R. and TOLBERT, P.S., 1997. Institutionalization and structuration: Studying the links between action and institution. *Organization Studies,* 18, pp. 93-117.

BARLOW,J. BAYER,S. CASTLETON,B. AND CURRY,R. (2005) Meeting government objectives for telecare in moving from local implementation to mainstream services. *Journal of Telemedicine and Telecare*, 11, 49-51

BARLOW, J., BURN, J. and LOCKHART, G., 2008. *All change please: Putting the best new healthcare ideas into practice.* London: Policy Exchange.

BENBASAT, I., GOLDSTEIN, D.K. and MEAD, M., 1987. The Case Research Strategy in Studies of Information Systems. *MIS Quarterly,* 11, pp. 369-386.

BERG, M., 2003. The Search for Synergy: Interrelating Medical Work and Patient Care Information Systems. *Methods of information in medicine,* 42, pp. 337-344.

BERG, M., 2001. Implementing information systems in health care organizations: myths and challenges. *International journal of medical informatics,* 64, pp. 143-156.

BERG, M., 1999. Patient care information systems and health care work: A sociotechnical approach. *International journal of medical informatics,* 55, pp. 87-101.

BERGHOUT, E. and REMENYI, D., 2005. The Eleven Years of the European Conference on IT Evaluation: Retrospectives and Perspectives for Possible Future Research" *The Electronic Journal of Information Systems Evaluation,* 8, pp. 81-98

BHATTACHERJEE, A. and HIKMET, N., 2007. Physicians' resistance toward healthcare information technology: a theoretical model and empirical test. *European Journal of Information Systems,* 16, pp. 725-737.

BIJKER, W.E., 1995. *Of bicycles, bakelites, and bulbs : toward a theory of sociotechnical change.* 1 edn. Cambridge:MA: MIT Press.

BLACK, J. L., CARLILE, R. P., REPENNING, P. N., 2004. A Dynamic Theory of Expertise and Occupational Boundaries in New Technology Implementation: Building on Barley's Study of CT Scanning. Administrative Science Quarterly, 49, pp. 572-607

BODDY, D., KING, G., CLARK, S. J., HEANEY, D., and MAIR, F. 2009. The influence of context and process when implementing e-health. *BMC Medical Informatics and Decision Making*, 9:9, doi:10.1186/1472-6947-9-9

BOONSTRA, A. and BROEKHUIS, M., 2010. Barriers to the acceptance of electronic medical records by physicians from systematic review to taxonomy and interventions. *BMC Health Services Research,* 10:231

BOUDREAU, M. and ROBEY, D., 2005. Enacting Integrated Information Technology: A Human Agency Perspective. *Organization Science,* 16, pp. 3-18.

BRAUN, V. and CLARKE, V., 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology,* 3, pp. 77-101.

BRATAN, M. T., 2007. *Design of a Generic Optimum System Architecture for Remote Patient Monitoring*. PhD thesis. Brunel University.

BROWN, A.D. and JONES, M.R., 1998. Doomed to failure: Narratives of inevitability and conspiracy in a failed IS project. *Organization Studies,* 19, pp. 73-88.

BROWN, M. and SHAW, N., 2008. Evaluation practices of a major Canadian telehealth provider: Lessons and future directions for the field. *Telemedicine and e-Health,* 14, pp. 769-774.

CALNAN, M. and ROWE, R., 2008. Trust relations in a changing health service. *Journal of health services research & policy,* 13, pp. 97-103.

CAMPBELL, M., FITZPATRICK, A., HAINES, A., KINMONTH, L. A., SANDEROCK, P., SPIEGELHALTER, D., and TYRER, P., 2000. Framework for design and evaluation of complex interventions to improve health. *British Medical Journal*, 321, pp. 694-696

CHAU, P.Y.K. and HU, P.J., 2001. Examining a model of information technology acceptance by individual professionals: An exploratory study. *Journal of Management Information Systems,* 18, pp. 191-229.

CHAU, P.Y.K. and HU, P.J., 2002. Investigating healthcare professionals' decisions to accept telemedicine technology: An empirical test of competing theories. *Information and Management,* 39(4), pp. 297-311.

CHO, S. 2007. *A contextualist approach to telehealth innovations*. PhD thesis. The Robinson College of Business of Georgia State University.

CHIASSON, M.W. and DAVIDSON, E., 2004. Pushing the contextual envelope: Developing and diffusing IS theory for health information systems research. *Information and Organization,* 14, pp. 155-188.

CIBORRA, C.U. and LANZARA, G.F., 1994. Formative contexts and information technology: Understanding the dynamics of innovation in organizations. *Accounting, Management and Information Technologies,* 4, pp. 61-86.

CLARKE, M. 2009 *Evaluation of remote patient monitoring*, Research protocol V1.1 04/03/09, Brunel University

CLARKE, M. BRATAN, T. JONES, R.W. LARKWORTHY, A., 2005. Providing Remote Patient Monitoring Services in Residential Care Homes. *Telemed and eHealth '05 – meeting healthcare challenges*, London, UK.

CLARKE, M. SHAH, S., and SHARMA, U., 2011. Systematic review of studies on telemonitoring of patients with congestive heart failure: a meta-analysis. *Journal of Telemedicine and Telecare*, 17, pp. 7–14

CLARK, M. and GOODWIN, N., 2010. *Sustaining innovation in telehealth and telecare.* UK: WSD Action Network.

CLARKE, J. and MEIRIS, D., 2006. Electronic Personal Health Records Come of Age, *American Journal of Medical Quality*, 21, pp.5S-15S.

CONSTANTINIDES, P. and BARRETT, M., 2006a. Large-scale ICT innovation, power, and organizational change: The case of a regional health information network. *Journal of Applied Behavioral Science,* 42, pp. 76-90.

CONSTANTINIDES, P. and BARRETT, M., 2006b. Negotiating ICT development and use: The case of a telemedicine system in the healthcare region of Crete. *Information and Organization,* 16, pp. 27-55.

CORNFORD, T., DOUKIDIS, G. and FORSTER, D., 1994. Experience with a structure, process and outcome framework for evaluating an information system. *Omega,* 22, pp. 491-504.

CORNFORD, T. and KLECUN-DABROWSKA, E., 2003. Images of Health Technology in National and Local Strategies. *Methods of information in medicine,* 42, pp. 353-359.

CRUICHSHANK, J., 2010. *Healthcare without walls: a framework for delivering healthcare at scale.* London. 2020health.

DA CUNHA, J.V. and ORLIKOWSKI, W.J., 2008. Performing catharsis: The use of online discussion forums in organizational change. *Information and Organization,* 18, pp. 132-156.

DARKE, P., SHANKS, G., and BROADBENT, M., 1998.Succesfully completing case study research: combining rigour, relevance and pragmatism. *Information Systems Journal*, 8, pp.273-289.

DAVIDSON, E., 2006. A technological frames perspective on information technology and organizational change. *Journal of Applied Behavioral Science,* 42, pp. 23-39.

DAVIDSON, E., 2002. Technology frames and framing: A socio-cognitive investigation of requirements determination. *MIS Quarterly: Management Information Systems,* 26, pp. 329-358.

DAVIDSON, E., 1997. Changing frames or framing change? Social cognitive implications of organizational change during IT adoption. *Hawaii International Conference on System Sciences (HICSS)* Volume 3: Information System Track-Organizational Systems and Technology, pp. 475-484.

DAVIDSON, E. and CHIASSON, M., 2005. Contextual influences on technology use mediation: A comparative analysis of electronic medical record systems. *European Journal of Information Systems,* 14, pp. 6-18.

DAVIDSON, E. and CHISMAR, W., 2007. The interaction of institutionally triggered and technology-triggered social structure change: An investigation of computerized physician order entry. *MIS Quarterly: Management Information Systems,* 31, pp. 739-758.

DAVIDSON, E. and HESLINGA, D., 2007. Bridging the IT adoption gap for small physician practices: An action research study on electronic health records. *Information Systems Management,* 24, pp. 15-28.

DAVIES, A., and NEWMAN, S., 2011. *Evalauting telecare and telehealth interventions*. WSD Action Network briefing paper. The Kings fund.

DE VAUJANY, F., 2005. Information Technology Conceptualization: Respective Contributions of Sociology and Information Systems. *Journal of Information Technology Impact,* 5, pp. 39-58.

DEPARTMENT OF HEALTH, 2010. *Improving the health and well-being of people with long term conditions. World class services for people with long term conditions: information tool for commissioners.* London.

DEPARTMENT OF HEALTH, 2005. *Supporting people with long term conditions: An NHS and social care model to support local innovation and integration.* London.

DESANCTIS, G. and POOLE, M., 1994. Capturing the complexity in advanced technology use: Adaptive structuration theory. *Organization Science,* 5, pp. 121-146.

DONABEDIAN, A., 2003. *An Introduction to Quality Assurance in Health Care.* 1 edn. Oxford: Oxford University Press.

DOOLIN, B., 2004. Power and resistance in the implementation of a medical management information system. *Information Systems Journal,* 14, pp. 343-362.

DOPSON, S., FITZGERALD, L., FERLIE, E., 2008 Understanding Change and Innovation in Healthcare Settings: Reconceptualizing the Active Role of Context. Journal of change management, 8, pp. 213-231

EDMONDSON, C. A., BOHMER, M, R., and PISANO, P, G., 2001 Disrupted Routines: Team Learning and New Technology Implementation in Hospitals *Administrative Science Quarterly*, 46, pp. 685-716

EYSENBACH, G., 2001. What is e-health? *Journal of Medical Internet Research*, 3:e20.

EYSENBACH, G. and TILL, J.E., 2001. Ethical issues in qualitative research on internet communities. *British medical Journal,* 323, pp.1103-1105

FAULKNER, A., 2009. *Medical technology into healthcare and society: a sociology of devices, innovation and governance.* 1 edn. UK: Palgrave Macmillan.

FELDMAN, M.S., 2003. A performative perspective on stability and change in organizational routines. *Industrial and Corporate Change,* 12, pp. 727-752.

FELDMAN, M.S., 2000. Organizational Routines as a Source of Continuous Change. *Organization Science,* 11, pp. 611-629.

FELDMAN, M.S. and PENTLAND, B.T., 2003. Reconceptualizing organizational routines as a source of flexibility and change. *Administrative Science Quarterly,* 48, pp. 94-118.

FELDMAN, M.S. and RAFAELI, A., 2002. Organizational routines as sources of connections and understandings. *Journal of Management Studies,* 39, pp. 309-331.

FEREDAY, J., AND MUIR-COCHRANE, E. 2006. Demonstrating Rigor Using Thematic Analysis: A Hybrid Approach of Inductive and Deductive Coding and Theme Development. *International Journal of Qualitative Methods,* 5.

FINCH, T., MAY, C., MORT, M. and MAIR, F., 2006. Telemedicine, Telecare, and the Future Patient: Innovation, Risk and Governance. In: A. WEBSTER, ed, *New Technologies in Healthcare Challenge, Change and Innovation.* 1st edn. P McMillan, pp. 84-96.

FINCH, T.L., MAY, C.R., MAIR, F.S., MORT, M. and GASK, L., 2003. Integrating service development with evaluation in telehealthcare: An ethnographic study. *British medical journal,* 327, pp. 1205-1208.

FINCH, T.L., MORT, M., MAIR, F.S. and MAY, C.R., 2008. Future patients? Telehealthcare, roles and responsibilities. *Health and Social Care in the Community,* 16, pp. 86-95.

FITZGERALD, L., FERLIE, E., HAWKINS, C., 2003. Innovation in healthcare: how does credible evidence influence professionals? *Health and Social Care in the Community*, 11, pp. 219–228

FITZGERALD, G., PIRIS, L., and SERRANO, A., 2008. Identification of Benefits and Barriers for the Adoption of E-HealthInformation Systems Using a Socio-Technical Approach. Proceedings of the *ITI 2008 30th Int. Conf. on Information Technology Interfaces,* Cavtat, Croatia

GAGNON, M.-., DUPLANTIE, J., FORTIN, J.-. and LANDRY, R., 2006. Implementing telehealth to support medical practice in rural/remote regions: What are the conditions for success? *Implementation Science,* 1, doi:10.1186/1748-5908-1-18

GAGNON, M.-., GODIN, G., GAGNÉ, C., FORTIN, J., LAMOTHE, L., REINHARZ, D. and CLOUTIER, A., 2003. An adaptation of the theory of interpersonal behaviour to the study of telemedicine adoption by physicians. *International journal of medical informatics,* 71, pp. 103-115.

GAMMON, D., JOHANNESSEN, L.K., SØRENSEN, T., WYNN, R. and WHITTEN, P., 2008. An overview and analysis of theories employed in telemedicine studies: A field in search of an identity. *Methods of information in medicine,* 47, pp. 260-269.

GARETS, D., and DAVIS, M., 2006. Electronic Medical Records vs. Electronic Health Records: Yes, There is a Difference. A HIMSS Analytics White Paper.

GASSER, L., 1986. The integration of computing and routine work. *ACM Trnasaction on Office Information Systems,* 4, pp. 205-225.

GIDDENS, A., 1991. *Modernity and self-identity : self and society in the late modern age.* Cambridge: Polity.

GIDDENS, A., 1990. *The consequences of modernity.* UK: Polity Press in association with Blackwell.

GIDDENS, A., 1984. *The constitution of society : outline of the theory of structuration.* Cambridge: Polity.

GIDDENS, A., 1979. *Central problems in social theory: action, structure and contradiction in social analysis.* London (etc.): Macmillan.

GREENHALGH, T., 2008. Role of routines in collaborative work in healthcare organisations. British Medical Journal, 337, pp. 1269-1271

GREENHALGH, T., HINDER, S., STRAMER, K., BRATAN, T. and RUSSELL, J., 2010. Adoption, non-adoption, and abandonment of a personal electronic health record: Case study of HealthSpace. *British Medical Journal,* 341, pp. 1091.

GREENHALGH, T., POTTS, H.W.W., WONG, G., BARK, P. and SWINGLEHURST, D., 2009. Tensions and paradoxes in electronic patient record research: A systematic literature review using the meta-narrative method. *Milbank Quarterly,* 87, pp. 729-788.

GREENHALGH, T., ROBERT, G., MACFARLANE, F., BATE, P., and KYRIAKIDOU, O., 2004. Diffusion of Innovations in Service Organizations: Systematic Review and Recommendations. The Milbank Quarterly, 82, pp.581-629.

GREENHALGH, T. and RUSSELL, J., 2010. Why do evaluations of eHealth programs fail? An alternative set of guiding principles. *PLoS Medicine,* 7, doi:10.1371/journal.pmed.1000360.

GREENHALGH, T. and STONES, R., 2010. Theorising big IT programmes in healthcare: Strong structuration theory meets actor-network theory. *Social Science and Medicine,* 70, pp. 1285-1294.

GREENHALGH, T., STRAMER, K., BRATAN, T., BYRNE, E., MOHAMMAD, Y. and RUSSELL, J., 2008. Introduction of shared electronic records: Multi-site case study using diffusion of innovation theory. *British Medical Journal,* 337, pp. 1040-1044.

GREGOR, S., 2006. The nature of theory in Information Systems. *MIS Quarterly: Management Information Systems,* 30, pp. 611-642.

HARDCASTLE, M.R., USHER, K.J. and HOLMES, C.A., 2005. An overview of structuration theory and its usefulness for nursing research. *Nursing Philosophy,* 6, pp. 223-234.

HARRISON, I.M., KOPPEL, R. and BAR-LEV, S., 2007. Unintended Consequences of Information Technologies in Health Care—An Interactive Sociotechnical Analysis. *Journal of the American Medical Informatics Association,* 42, pp. 542-549.

Hayrinen, K. Saranto, K. and Nykanen, P. (2008) 'Definition, structure, content, use and impact of electronic health records: A review of the research literature', *International Journal of Medical Informatics*, 77, pp. 291-304.

HEAVEN, B., MURTAGH, M., RAPLEY, T., MAY, C., GRAHAM, R., KANER, E. and THOMSON, R., 2006. Patients or research subjects? A qualitative study of participation in a randomised controlled trial of a complex intervention. *Patient education and counseling,* 62, pp. 260-270.

HEEKS, R., 2006. Health information systems: Failure, success and improvisation. *International Journal of Medical Informatics,* 75, pp. 125-137.

HENDY, J., REEVES, B.C., FULOP, N., HUTCHINGS, A. and MASSERIA, C., 2005. Challenges to implementing the national programme for information technology (NPfIT): A qualitative study. *British medical journal,* 331, pp. 331-334.

HIBBERT, D., MAIR, F.S., MAY, C.R., BOLAND, A., O'CONNOR, J., CAPEWELL, S. and ANGUS, R.M., 2004. Health professionals' responses to the introduction of a home telehealth service. *Journal of telemedicine and telecare,* 10, pp. 226-230.

ILES, V. and SUTHERLAND, K., 2002. *Managing change in the NHS Organisational Change: A review for health care managers, professionals and researchers.* UK: e National Coordinating Centre for the Service Delivery.

JACKSON, H.M., POOLE, M.S. and KUHN, T., 2002. THE SOCIAL CONSTRUCTION OF TECHNOLOGY IN STUDIES OF THE WORKPLACE. *The handbook of new media: social shaping and consequences of ICTs.* Lievrouw, A. L.; Livingstone, M. S. edn. SAGE Publications Ltd., pp. 236-253.

JENSEN, T., KJÆRGAARD, A. and SVEJVIG, P., 2009. Using institutional theory with sensemaking theory: a case study of information system implementation in healthcare. *Journal of Information Technology,* 24, pp. 343-353.

JENSEN, T.B. and AANESTAD, M., 2007a. Hospitality and hostility in hospitals: A case study of an EPR adoption among surgeons. *European Journal of Information Systems,* 16, pp. 672-680.

JENSEN, T.B. and AANESTAD, M., 2007b. How healthcare professionals "make sense" of an electronic patient record adoption. *Information Systems Management,* 24, pp. 29-42.

JONES, M. and ORLIKOWSKI, W., 2007. Information Technology and the Dynamics of Organisational Change. In: R. MANSELL, C. AVGEROU, D. QUAH and R. SILVERSTONE, eds, *The Oxford Handbook of Information and Communication Technologies.* 1st edn. New York: Oxford University Press, pp. 293-313.

JONES, M., ORLIKOWSKI, W. and MUNIR, K., 2004. Structuration theory and information systems: A critical reappraisal. In: J. MINGERS and L. WILLCOCKS, eds, *Social theory and philosophy for information systems.* 1 edn. UK: John Wiley & Sons, Ltd., pp. 297-328.

JONES, M.R., 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, pp. 410-415.

JONES, M.R. and KARSTEN, H., 2008. Giddens's Structuration Theory and Information Systems Research. *MIS Quarterly,* 32, pp. 127-157.

JOSHI, K., 1991. A Model of Users' Perspective on Change: The Case of Information Systems Technology Implementation. *MIS Quarterly,* 15, pp. 229-242.

KAPLAN, B., 2001. Evaluating informatics applications - Some alternative approaches: Theory, social interactionism, and call for methodological pluralism. *International journal of medical informatics,* 64, pp. 39-56.

KLEIN, H.K. and KLIENMAN, L.D., 2002. The Social Construction of Technology: Structural Considerations. *Science, Technology, & Human Values,* 27, pp. 28-52.

KLEIN, H.K. and MYERS, M.D., 1999. A set of principles for conducting and evaluating interpretive field studies in information systems. *MIS Quarterly: Management Information Systems,* 23, pp. 67-94.

KLING, R. and IACONO, S., 1984. CONTROL OF INFORMATION SYSTEMS DEVELOPMENTS AFTER IMPLEMENTATION. *Communications of the ACM,* 27(12), pp. 1218-1226.

KOUROUBALI, A., 2002. Structuration Theory and Conception-Reality Gaps: Addressing Cause and Effect of Implementation Outcomes in Health Care Information Systems. *Proceedings of the 35th Hawaii International Conference on System Sciences.*

KRUEGER, A.R. and CASEY, A.M., 2000. *Focus groups: a practical guide for applied research.* 3 edn. USA: SAGE Publication, Inc.

LANCASTER, G.A., CAMPBELL, M.J., ELDRIDGE, S., FARRIN, A., MARCHANT, M., MULLER, S., PERERA, R., PETERS, T.J., PREVOST, A.T. and RAIT, G., 2010. Trials in primary care: Statistical issues in the design, conduct and evaluation of complex interventions. *Statistical methods in medical research,* 19, pp. 349-377.

LANKSHEAR, G. and MASON, D., 2001. Technology and ethical dilemmas in a medical setting: Privacy, professional autonomy, life and death. *Ethics and Information Technology,* 3, pp. 225-235.

LAPOINTE, L. and RIVARD, S., 2005. A multilevel model of resistance to information technology implementation. *MIS Quarterly: Management Information Systems,* 29, pp. 461-491.

LATOUR, B., 1999. On recalling ANT. In: J. LAW and J. HASSARD, eds, *Actor Network Theory and after.* 1 edn. UK: Blackwell Publishing, pp. 15-25.

LAW, J. and CALLON, M., 1992. The Life and Death of an Aircraft: A Network Analysis of Technical Change. In: BIJKER W. and J. LAW, eds, Shaping technology/building society: studies in sociotechnical change. 1 edn. MIT, pp. 21-52.

LEE, T., 2004. Nurses' adoption of technology: Application of Rogers' innovation-diffusion model. *Applied Nursing Research,* 17, pp. 231-238.

LEHOUX, P., 2008. The duality of health technology in chronic illness: How designers envision our future. *Chronic Illness,* 4, pp. 85-97.

LEHOUX, P., SICOTTE, C., DENIS, J., BERG, M. and LACROIX, A., 2002. The theory of use behind telemedicine: : how compatible with physicians' clinical routines? *Social science & medicine,* 54, pp. 889-904.

LEWIN, S., GLENTON, C., and OXMAN, A. 2009. Use of qualitative methods alongside randomised controlled trials of complex healthcare interventions; methodological study. British medical Journal, 339:b3496, doi 10.1136/bmj.b3469.

LI, X., HESS, J. T., and VALACICH, S. J., 2008 Why do we trust new technology? A study of initial trust formation with organizational information systems. Journal of Strategic Information Systems 17, pp 39–71

LINCOLN, S.Y. and GUBA, G.E., 1985. *Naturalistic Inquiry.* 1 edn. USA: SAGE Publications, Inc.

LinkedIn website:http://www.linkedin.com/

LIPPERT, S.K. and DAVIS, M., 2006. A conceptual model integrating trust into planned change activities to enhance technology adoption behavior. *Journal of Information Science,* 32, pp. 434-448.

LIPPERT, S.K. and SWIERCZ, M. P., 2005. Human resource information systems (HRIS) and technology trust. *Journal of Information Science,* 31, pp. 340-353.

MAIR, F., FINCH, T., MAY, C., HISCOCK, J., BEATON, S., GOLDSTEIN, P. and MCQUILLAN, S., 2007a. Perceptions of risk as a barrier to the use of telemedicine. *Journal of telemedicine and telecare,* 13, pp. 38-39.

MAIR, F.S., MAY, C., FINCH, T., MURRAY, E., ANDERSON, G., SULLIVAN, F., O'DONNELL, C., WALLACE, P. and EPSTEIN, O., 2007b. Understanding the implementation and integration of e-health services. *Journal of telemedicine and telecare,* 13, pp. 36-37.

MARKUS, M. and DANIEL, R., 1988. Information Technology and Organizational Change: Causal Structure in Theory and Research. *Management Science,* 34, pp. 583-598.

MAY, C., 2007. The clinical encounter and the problem of context. *Sociology,* 41, pp. 29-45.

MAY, C., 2006a. Mobilising modern facts: Health technology assessment and the politics of evidence. *Sociology of Health and Illness,* 28, pp. 513-532.

MAY, C., 2006b. A rational model for assessing and evaluating complex interventions in health care. *BMC Health Services Research,* 6.

MAY, C., 1992. Nursing work, nurses' knowledge, and the subjectification of the patient. *Sociology of Health and Illness,* 14, pp. 472-487.

MAY, C., 1993. Subjectivity and culpability in the constitution of nurse-patient relationships. *International journal of nursing studies,* 30, pp. 181-192.

MAY, C., ALLISON, G., CHAPPLE, A., CHEW-GRAHAM, C., DIXON, C., GASK, L., GRAHAM, R., ROGERS, A. and ROLAND, M., 2004. Framing the doctor-patient relationship in chronic illness: A comparative study of general practitioners' accounts. *Sociology of Health and Illness,* 26, pp. 135-158.

MAY, C. and FINCH, T., 2009. Implementing, embedding, and integrating practices: An outline of normalization process theory. *Sociology,* 43(3), pp. 535-554.

MAY, C., FINCH, T., MAIR, F., BALLINI, L., DOWRICK, C., ECCLES, M., GASK, L., MACFARLANE, A., MURRAY, E., RAPLEY, T., ROGERS, A., TREWEEK, S., WALLACE, P., ANDERSON, G., BURNS, J. and HEAVEN, B., 2007a. Understanding the implementation of complex interventions in health care: The normalization process model. *BMC Health Services Research,* 7.

MAY, C., FINCH, T., MAIR, F. and MORT, M., 2005. Towards a wireless patient: Chronic illness, scarce care and technological innovation in the United Kingdom. *Social science & medicine,* 61, pp. 1485-1494.

MAY, C. and ELLIS, N.T., 2001. When protocols fail: technical evaluation, biomedical knowledge, and the social production of 'facts' about a telemedicine clinic. *Social science & medicine,* 53, pp. 989-1002.

MAY, C., GASK, L., ATKINSON, T., ELLIS, N., MAIR, F. and ESMAIL, A., 2001. Resisting and promoting new technologies in clinical practice: the case of telepsychiatry. *Social science & medicine,* 52, pp. 1889-1901.

MAY, C., HARRISON, R., FINCH, T., MACFARLANE, A., MAIR, F., WALLACE, P. and FOR THE TELEMEDICINE ADOPTION STUDY GROUP, 2003a. Understanding the normalization of telemedicine services through qualitative evaluation. *Journal of the American Medical Informatics Association,* 10, pp. 596-604.

MAY, C., HARRISON, R., MACFARLANE, A., WILLIAMS, T., MAIR, F. and WALLACE, P., 2003b. Why do telemedicine systems fail to normalize as stable models of service delivery? *Journal of Telemedivine and Telecare,* 9, pp. S1:25-S1:26.

MAY, C.R., MAIR, F.S., DOWRICK, C.F. and FINCH, T.L., 2007b. Process evaluation for complex interventions in primary care: Understanding trials using the normalization process model. *BMC Family Practice,* 8.

MAY, C., MAIR, F., FINCH, T., MACFARLANE, A., DOWRICK, C., TREWEEK, S., RAPLEY, T., BALLINI, L., ONG, B., ROGERS, A., MURRAY, E., ELWYN, G., LÉGARÉ, F., GUNN, J. and MONTORI, V., 2009. *Development of a theory of implementation and integration: Normalization Process Theory.* http://www.implementationscience.com/content/4/1/29 edn. Biomed Central Ltd.

MAY, C., MORT, M., WILLIAMS, T., MAIR, F. and GASK, L., 2003. Health technology assessment in its local contexts: studies of telehealthcare. *Social science & medicine,* 57(4), pp. 697-710.

MCDONALD, A.M., KNIGHT, R.C., CAMPBELL, M.K., ENTWISTLE, V.A., GRANT, A.M., COOK, J.A., ELBOURNE, D.R., FRANCIS, D., GARCIA, J., ROBERTS, I. and SNOWDON, C., 2006. What influences recruitment to randomised controlled trials? A review of trials funded by two UK funding agencies. *Trials,* 7:9 doi:10.1186/1745-6215-7-9.

MCEVILY, B., PERRONE, V. and ZAHEER, A., 2003. Trust as an organizing principle. *Organization Science,* 14, pp. 91-103.

MCGRATH, K., HENDY, J., KLECUN, E., WILLCOCKS, L. and YOUNG, T., 2008. *Evaluating "connecting for Health": Policy implications of a UK mega-programme.*

MCLEAN, S., PROTTI, D., and SHEIKH, A., 2011. Telehealthcare for long term conditions. *British medical journal*, 342, pp. 374-378

MEDICAL RESEARCH COUNCIL, 2000. *A framework for development and evaluation of RCTs for complex intervention to improve health.* UK.

MOHAMMAD. M. Y., 2010. *Information security strategy in Telemedicine and e-Health systems: A case study of England's Shared Electronic Health Record System*. PhD thesis. Brunel University.

MORT, M., MAY, C.R. and WILLIAMS, T., 2003. Remote doctors and absent patients: Acting at a distance in telemedicine? *Science Technology and Human Values,* 28, pp. 274-295.

MORT, M. and SMITH, A., 2009. Beyond information: Intimate relations in sociotechnical practice. *Sociology,* 43, pp. 215-231.

MURPHY, E., DINGWALL, R., GREATBATCH, D., PARKER, S. and WATSON, P., 1998. *Qualitative research methods in health technology assessment: a review of the literature.* 2(16). UK: Health Technology Assessment.

MURRAY, E., BURNS, J., MAY, C., FINCH, T., O'DONNELL, C., WALLACE, P., MAIR, F. 2011. Why is it difficult to implement e-health initiatives? A qualitative study. Implementation Science, 6(6), doi:10.1186/1748-5908-6-6

MYERS, M.D., 2009. *Qualitative research in business and management.* SAGE.

NICOLINI, D., 2010. Medical innovation as a process of translation: A case from the field of telemedicine. *British Journal of Management,* 21, pp. 1011-1026.

NICOLINI, D., 2007. Stretching out and expanding work practices in time and space: The case of telemedicine. *Human Relations,* 60, pp. 889-920.

NICOLINI, D., 2006. The work to make telemedicine work: A social and articulative view. *Social Science and Medicine,* 62, pp. 2754-2767.

NOTTINGHAM CITY COUNCIL, 12 October, 2009-last update. Available: www.nottinghamcity.gov.uk [5 February, 2011].

ORLIKOWSKI, W.J. and SCOTT, V.S., 2008. "Sociomateriality: challenging the separation of technology, work and organisation". Working paper series. LSE

ORLIKOWSKI, W.J., 2007. Sociomaterial practices: Exploring technology at work. *Organization Studies,* 28, pp. 1435-1448.

ORLIKOWSKI, W.J., 2002. Knowing in practice: Enacting a collective capability in distributed organizing. *Organization Science,* 13, pp. 249-273.

ORLIKOWSKI, W.J., 2000. Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations. *Organization Science,* 11, pp. 404-428.

ORLIKOWSKI, W.J., 1992. The Duality of Technology: Rethinking the Concept of Technology in Organizations. *Organization Science,* 3, pp. 398-427.

ORLIKOWSKI, W.J. and BARLEY, S.R., 2001. Technology and institutions: What can research on information technology and research on organizations learn from each other? *MIS Quarterly: Management Information Systems,* 25, pp. 145-165.

ORLIKOWSKI, W.J. and BAROUDI, J.J., 1991. Studying Information Technology in Organizations: Research Approaches and Assumptions. *Information Systems Research,* 2, pp. 1-28.

ORLIKOWSKI, W.J. and GASH, C.D., 1994. Technological Frames: Making Sense of Information Technology in Organizations. *ACM TransactIons on Information Systems,* 12, pp. 174-207.

ORLIKOWSKI, W.J. and IACONO, C.S., 2001. Research Commentary: Desperately Seeking the "IT" in IT Research - A Call to Theorizing the IT Artifact. *Information Systems Research,* 12, pp. 121-134.

ORLIKOWSKI, J.W., WALSHAM, G., JONES, R.M. and DEGROSS, I.J., eds, 1996. *Information technology and changes in organisational work.* 1 edn. UK: Chapman & Hall.

OUDSHOORN, N., 2008. Diagnosis at a distance: The invisible work of patients and healthcare professionals in cardiac telemonitoring technology. *Sociology of Health and Illness,* 30, pp. 272-288.

PEDDLE, K., 2007. Telehealth in Context: Socio-technical Barriers to Telehealth use in Labrador, Canada. *Computer Supported Cooperative Work,* 16, pp. 595-614.

PETTIGREW, A.M., 1997. What is processual analysis. Scandinavian Journal of Management, 13, pp 337-348.

PETTIGREW, A.M., 1990. Longitudinal field research on change: theory and practice. *Organisation Sciences ,* 1, pp. 267-292

PETTIGREW, A.M., 1987. CONTEXT AND ACTION IN THE TRANSFORMATION OF THE FIRM. *Journal of Management Studies,* 24, pp. 649-670.

PETTIGREW, A.M., 1985. Contextualist research: a natural way to link theory and practice. In: E.E.E.A. LAWLER, ed, *Doing research that is useful for theory and practice.* San Francisco: Jossey-Bass, pp. 222-259.

PETTIGREW, A.M., WOODMAN, R.W. and CAMERON, K.S., 2001. Studying organizational change and development: Challenges for future research. *Academy of Management Journal,* 44, pp. 697-713.

PICKERING, A., 1993. The Mangle of Practice: Agency and Emergence in the Sociology of Science. *The American Journal of Sociology,* 99, pp. 559-589

PINCH, J.T. and BIJKER E. W., 1984. The Social Construction of Facts and Artefacts: or How the ociology of Science and the Sociology of Technology might Benefit Each Other. *Social Studies of Science,* 14, pp. 399-441.

POZZEBON, M. AND PINSONNEAULT, A., 2005. Challenges in Conducting Empirical Work Using Structuration Theory: Learning from IT Research. *Organization Studies,* 26, pp. 1353-1376.

PRESIDENT'S COUNCIL OF ADVISORS ON SCIENCE AND TECHNOLOGY, 2010. *Report to the President, Realising the full potential of health information technology to improve healthcare for Americans: the path forward.* US: PCAST.

RAPLEY, T., MAY, C., HEAVEN, B., MURTAGH, M., GRAHAM, R., KANER, E.F.S. and THOMSON, R., 2006. Doctor–patient interaction in a randomised controlled trial of decision-support tools. *Social science & medicine,* 62, pp. 2267-2278.

REARDON, J.L. and DAVIDSON, E., 2007a. How do doctors perceive the organizing vision for electronic medical records? Preliminary findings from a study of EMR adoption in independent physician practices, In *Proceedings of the 40th Annual Hawaii International Conference on System Sciences* (HICSS '07). IEEE Computer Society, Washington, DC, USA.

REARDON, J.L. and DAVIDSON, E., 2007b. An organizational learning perspective on the assimilation of electronic medical records among small physician practices. *European Journal of Information Systems,* 16, pp. 681-694.

RECTOR, A., NOLAN, W., and KAY, S., 1991. Foundation for an Electronic Medical Record, *Methods of Information in Medicine*, 30, pp. 179-86.

ROBERT, G., GREENHALGH, T., MACFARLANE, F., PEACOCK, R., 2009. Organisational factors influencing technology adoption and assimilation in the NHS: a systematic literature review. Report for the National Institute for Health Research Service Delivery and Organisation Programme.UK.

ROBERT, G., GREENHALGH, T., MACFARLANE, F., PEACOCK, R., 2010. Adopting and assimilating new non-pharmaceutical technologies into healthcare: a systematic review. *Journal of Health Services Research & Policy*, 15, 243–250

ROE, M. A., and LIBERMAN, A., 2007. A Comparative Analysis of the United Kingdom and the United States Health Care Systems. *The Health Care Manage*r, 26, pp. 190–212

ROGERS, M.E., 2003. *Diffusion of innovations.* 5 edn. Free Press.

ROSEN, R., and MAYS, N. 1998. The impact of the UK NHS purchaser-provider split on the rational introduction of new medical technologies. Health policy, 43, pp 103-123

ROWE, R. and CALNAN, M., 2006. Trust relations in health care: Developing a theoretical framework for the "new" NHS. *Journal of Health, Organisation and Management,* 20, pp. 376-396.

RUNCIMAN, B., 2010. *Health Informatics.* UK: British Computer Society.

SALLAS, B., LANE, S., MATHEWS, R., WATKINS, T. and WILEY-PATTON, S., 2007. An iterative assessment approach to improve technology adoption and implementation decisions by healthcare managers. *Information Systems Management,* 24, pp. 43-57.

SANDELOWSKI, M., 2001. Visible humans, vanishing bodies, and virtual nursing: Complications of life, presence, place, and identity. *Advances in Nursing Science,* 24, pp. 58-70.

SHAH, G. S., and Robinson, I. 2011. Patients' perspectives on self-testing of oral anticoagulation therapy: Content analysis of patients' internet blogs. BMC Health Services Research 2011, 11:25

SCHULTZE, U. and BOLAND, R. J., 2000. Knowledge management technology and the reproduction of knowledge work practices. *Journal of Strategic Information Systems,* 9, pp. 193-212.

SEALE, C., CHARTERIS-BLACK, J., MACFARLANE, A. and MCPHERSON, A., 2010. Interviews and internet forums: A comparison of two sources of qualitative data. *Qualitative health research,* 20, pp. 595-606.

SHARMA, U., BARNETT, J. and CLARKE, M., 2011. Clinical users' perspective on telemonitoring of patients with long term conditions: Understood through concepts of Giddens's structuration theory & consequence of modernity, *Information Systems Theory: Explaining and Predicting Our Digital Society,* Vol2.

SHARPE, C.C. 2001. Telenursing: Nursing practice in cyberspace. Westport, Connecticut.

SHIN, D., 2010. The effects of trust, security and privacy in social networking: A security-based approach to understand the pattern of adoption. *Interacting with Computers,* 22, pp. 428-438.

SICOTTE, C. and LEHOUX, P., 2003. Teleconsultation: Rejected and Emerging Uses. *Methods of information in medicine,* 42, pp. 451-457.

STAR, S.L. and STRAUSS, A., 1999. Layers of Silence, Arenas of Voice: The Ecology of Visible and Invisible Work. *Computer Supported Cooperative Work: CSCW: An International Journal,* 8, pp. 9-30.

SYMONS, J.V., 1991. A review of information systems evaluation: content, context and process. *European Journal of Information Systems*, 1, pp. 205–212.

TAYLOR, P., 2005. Evaluating telemedicine systems and services. *Journal of telemedicine and telecare,* 11, pp. 167-177.

THOMPSON, A., 2004. Confessions of an IS consultant or the limitations of structuration theory. *Cambridge Research Papers in Management Studies,* No. 1.

TIMMONS, S. HARRISON-PAUL, R. AND CROSBIE, B., 2008. How do lay people come to trust the Automatic External Defibrillator? *Healtk, Risk & Society,* 10, pp. 207-220.

TIMMONS, S., 2003. A failed panopticon: Surveillance of nursing practice via new technology. *New Technology, Work and Employment,* 18, pp. 143-153.

TJORA, A.H. and SCAMBLER, G., 2009. Square pegs in round holes: Information systems, hospitals and the significance of contextual awareness. *Social Science and Medicine,* 68, pp. 519-525.

VAAST, E. and WALSHAM, G., 2005. Representations and actions: The transformation of work practices with IT use. *Information and Organization,* 15, pp. 65-89.

WALSHAM, G., 2006. Doing interpretive research. *European Journal of Information Systems,* 15, pp. 320-330.

WALSHAM, G., 1997. IT and Changing Professional Identity: Micro-Studies and Macro-Theory. *Journal of the American Society for Information Sceince,* 49, pp. 1081-1089.

WALSHAM, G., 1993. *Interpreting information systems in organisations.* 1 edn. US: John Wiley & Sons Inc.

WALSHAM, G., 1995a. Interpretive case studies in IS research: nature and method. *European Journal of Information Systems,* 4, pp. 74-81.

WALSHAM, G., 1995b. The emergence of interpretivism in IS research. *Information Systems Research,* 6, pp. 376-394.

WALSHAM, G. and HAN, K., 1991. Structuration Theory and Information Systems Research. *Journal of Applied System Analysis,* 17, pp. 77-85.

WALSHAM, G. and WAEMA, T., 1994. Information systems strategy and implementation: a case study of a building society. *ACM Transactions on Information Systems,* 12, pp. 150-173.

WALTER, Z. and LOPEZ, M.S., 2008. Physician acceptance of information technologies: Role of perceived threat to professional autonomy. *Decision Support Systems,* 46, pp. 206-215.

WATERWORTH, S., MAY, C. and LUKER, K., 1999. Clinical 'effectiveness' and 'interrupted' work. *Clinical Effectiveness in Nursing,* 3, pp. 163-169.

WEARS, R.L. and BERG, M., 2005. Computer technology and clinical work: Still waiting for godot. *Journal of the American Medical Association,* 293, pp. 1261-1263.

WEBER, 2004. The Rhetoric of Positivism Versus Interpretivism: A Personal View. *MIS Quarterly: Management Information Systems,* 28(1), pp. iii-xii.

WHITTEN, P., 2006. Telemedicine: Communication technologies That revolutionize healthcare services. *Generations,* 30(2), pp. 20-24.

WHITTEN, P. and ADAMS, I., 2003. Success and failure: A case study of two rural telemedicine projects. *Journal of telemedicine and telecare,* 9, pp. 125-129.

WHITTEN, P., JOHANNESSEN, L.K., SOERENSEN, T., GAMMON, D. and MACKERT, M., 2007. A systematic review of research methodology in telemedicine studies. *Journal of telemedicine and telecare,* 13, pp. 230-235.

WHITTEN, P. and MICKUS, M., 2007. Home telecare for COPD/CHF patients: Outcomes and perceptions. *Journal of telemedicine and telecare,* 13, pp. 69-73.

WHITTEN, P.S. and MACKERT, M.S., 2005. Addressing telehealth's foremost barrier: Provider as initial gatekeeper. *International Journal of Technology Assessment in Health Care,* 21, pp. 517-521.

WIJNIA, E., 2004. *Understanding Weblogs: a communicative perspective.*, University of Twente.

WILLIAMS, R. and EDGE, D., 1996. The social shaping of technology. *Research Policy,* 25, pp. 865-899.

WILLIAMS, T., MAY, C., MAIR, F., MORT, M. and GASK, L., 2003. Normative models of health technology assessment and the social production of evidence about telehealth care. *Health Policy,* 64, pp. 39-54.

WOOTTON, R., DIMMICK, L.S. and KVEDAR, C.J., eds, 2006. *Home telehealth: connecting care within the community.* 1 edn. UK: Royal Society of Medicine Press Ltd.

YAMAMOTO, L. G., KHAN, A.N., 2006. Challenges of Electronic Medical Record, Implementation in the Emergency Department. *Pediatric Emergency Care*, 22, pp. 184-191

YIN, K.R., 2003. *Case study research Design and methods.* 3 edn. USA: SAGE Publications, Inc.

YIN, R.K., 1999. Enhancing the quality of case studies in health services research. *Health services research,* 34, pp. 1209-1224.

YIN, R.K., 1981. The Case Study as a Serious Research Strategy. *Science communication,* 3, pp. 97-114.

ZAHEER, A., MCEVILY, B. and PERRONE, V., 1998. Does Trust Matter? Exploring the Effects of Interorganizational and Interpersonal Trust on Performance. *Organization Science,* 9, pp. 141-159.

ZUBOFF, S., 1988. *In the Age of the Smart Machine: The Future of Work and Power.* 1 edn. US.

Appendices

Appendix A: Focus Group Discussion (Procedure and questions)

Procedure1: Welcome and general information

 ➢ Greetings: *good afternoon!*

 ➢ *Thank you for taking part in this meeting today. We will honour your time by making sure that we finish the session on time*

 ➢ *This session will be recorded for our records, does anyone mind if we do so?*

 ➢ *Information that you provide us today will be confidential and anonymous.*

 ➢ *This evaluated process would result in publishable journal article and a Ph.D. thesis. You're welcome to request for a copy.*

 ➢ *Any questions before we start*

Procedure2: why are we here and why does your input and participation mattress

The purpose of the study for which this focus group is conducted is truly sitting in the stand clinical use of perception and attitude to words telehealth services. Because you are part of a pioneering and potentially successful telehealth project in Nottingham shire, your views and input will help other telehealth projects nationally, about essential factors that require salient concentration for smooth rollout.

............5min

Procedure3: discussion session

1. Opening question

> We would like you to introduce yourself by saying your name and how long you have been working with service

...........5min (Talk)

2. Introductory question

> 2.1 How did you learn about the telehealth service?
>
> 2.2 How has the start-up process been for you?

...........10min (Talk)

3. Translation question

> What does telehealth mean to you?

Participants are asked to list the first 4 to 5 words that come to mind on a paper provided.

They are given approximately 2 minutes to brainstorm and write down their initial thoughts.

............10min (Talk & Activity)

4. Key questions

4.1 What do you like about this service?

Participants are given approximately a minute to brainstorm and list each element and a post-it note provided. Discussion on these and immense if then proceeded.

4.2 What do you dislike about this service?

Participants are once again given a minute to brainstorm and list each element that comes to mind on a post-it note provided, this time the colour of post-it note is different to the one provided earlier to distinguish between the disadvantages and advantages. Discussion on these elements if then proceeded.

4.3 What support do you require to freely familiarise with the service and use it successfully?

Participants are a human and minute to brainstorm and list each element when a post-it note provided. Discussion on these agreements is then preceded.

4.4 We are interested in your impression on how the telehealth service that you have discussed has impacted you*?*

Probe work routines, record keeping, efficiency, delivery of care, motivation.

4.5 How has the service impacted your patient?

Probe motivation, awareness , anxious, cooperative, apprehensive

............30min (Talk & Activity)

5. End questions

5.1 If you were to change one thing about this service, what would it be?

5.2 We wanted you to help us outline your perceptions and attitudes about the telly monitoring of your patience at home. Is there anything we missed? Or something that you want it to stay but did not get chance to do so?

While concluding the discussion, participants are asked to take about five minutes and stick a post-it notes the earlier used to signal out what they liked and disliked about the service on the chart provided.

............10min (Talk & Activity)

Appendix B: Semi-structured interview (procedure and questions) For Nurses and Community Support Workers

Thank you very much for agreeing to be interviewed. As you may know that I spoke to you/some of your colleagues involved in telehealth and its evaluation a while ago, and I am now really keen to find out your perspectives on what has been happening so far in regards to the service.

Do you mind if the conversation is recorded?

Well, this interview contains two sections. One pertains to telehealth while the other involves reflecting on its evaluation through randomised controlled trial. Can I assure you again that anything you say is in confidence, when I report these interviews as part of my Ph.D. no names will be included, and no names will ever be linked to particular views.

The other thing to say is that of course they are in no right answers to any of the questions I ask-I am simply interested in your views.

Okay, can we start by talking about the:

1. Training that you had for telehealth.

    1.1 Can you tell me a bit about it and what you thought about the overall procedure?

    1.2 What were the good things about this training? And

    1.3 What was the not so good things about this training?

    1.4 What about the training of the patient? How does that work. What are your views on this? *(Possible prompt if needed: who is training the patients?)*

2**.** How do you think that the introduction of telehealth has affected your interaction:

    2.1 with your patients? If so, how? (*Prompts: that is interesting, can you tell me a bit more about that)*

    2.2 with your colleagues? If so, how?

3. How has your job role changed since we last met? And what would you say are the main ways that the introduction of telehealth has affected the daily work?

(Probe to explore how they feel about these changes)

4. What in your opinion went wrong in this particular case of telehealth service implementation?

Okay, now in regards to the RCT:

5. What did you and your patients think of RCT?

(Prompt: the selection criteria, research strategy)

6. What in your opinion went wrong in case of RCT?

(Prompt: timing of commencing the RCT, support, paperwork involved)

7. Were you surprised by its sudden withdrawal?

Finally,

8. If you were giving advice to anyone starting telly health service in another area what would you say? What do you think would be the most important things that they should do to make it successful? And what should be definitely avoided?

Once again, thank you for taking part. Is there anything that you wanted to ask me? Please feel free to do so.

Appendix C: Semi-structures interview (procedure and questions) For managers

Thank you very much for agreeing to be interviewed. I am keen to find out your perspectives on what has been happening so far in regards to the telehealth service.

Do you mind if the conversation is recorded?

Well, this interview contains two sections. One pertains to telehealth while the other involves reflecting on its evaluation through randomised controlled trial. Can I assure you again that anything you say is in confidence, when I report these interviews as part of my Ph.D. no names will be included, and no names will ever be linked to particular views.

The other thing to say is that of course they are in no right answers to any of the questions I ask-I am simply interested in your views.

Okay, can we start by talking about the:

1. Kind of decisions that you had to make while proposing the deployment of telehealth on a large scale, could you shed some light on this?

2. What areas of difficulty were anticipated in this?

3. In terms of how it turned out, did anything surprising? Looking back now on how clinical staff were informed about the new service and how it was done what do you think what had been done differently?

4. What do you think the main concerns of those actually working on the ground with patience using telly health were?

5. In regards to the evaluation of telehealth with randomised control trial, what in your opinion went wrong? How do you think it could have been done differently?

Finally,

6. If you were giving advice to anyone starting a telly health service in another area what would you say? Similarly, if you were to advise to someone evaluating telehealth what would you say?

Once again, thank you for taking part. Is there anything that you wanted to ask me? Please feel free to do so.

Appendix D: Discussion Forum analysis sheets

S No.	Name	Position	Total No.	Comment S No.

Appendix D: Discussion Forum analysis sheets