Chapter 2:   Adverse Incident Recording & Reporting Systems

2.1 Introduction

The previous chapter established that healthcare organizations can improve patient safety by learning from adverse incidents. In order to learn from adverse incidents, healthcare organizations need reporting systems that can collect data for analysis and dissemination. Worldwide, healthcare has lagged behind other high risk industries such as aviation and nuclear power in implementing adverse incident recording and reporting systems (Leape, 1994; Barack & Small, 2000). This chapter reviews the literature on adverse incident reporting systems in healthcare. It makes a case for adopting a socio-technical systems approach for investigating the research question and introduces a model by Heeks *et al* (1999) which will be used as the conceptual foundation for the research.

2.2   Adopting new (electronic) technology for recording and reporting adverse incidents in healthcare

A number of high profile studies (Kohn *et al.*, 1999, Department of Health, 2000) have established the enormity of patient harm from medical errors. In 2001, The Institute of Medicine (IOM) published a report called 'Crossing the Quality Chasm' (Corrigan *et al.*, 2001). This report identified information technology as a means by which adverse incidents could be detected and prevented in order to improve patient safety but it did not identify the approach for implementing and sustaining such technology.

Garrett (2009) argued that healthcare has slowly moved towards the adoption of new technology to meet the growing concerns over patient care and safety. He argued that electronic reporting systems can speed up information sharing between health care professionals and other organisations which should improve patient safety. Despite this, Garrett (2009) reflected that health care organisations are very reluctant to give up paper systems for reporting adverse incidents, and that using electronic health care records requires a ' great deal of trust in the new system'.

Runciman *et al.,* (2006) identified other benefits of electronic reporting systems in healthcare. He argued that they can assist a member of staff to provide a narrative of the patient incident. Another benefit of the electronic technology is that data can be entered quickly into the system and then classified and analyzed by the computer quickly. Similar to Garrett (2009), Runciman *et al.,* (2006) argues that a benefit of electronic reporting technology is that it can collect, store, and transmit data but Runciman *et al.,* (2006) stresses the importance of being able to do this with clinical data. Adopting electronic systems has been thought to be the solution rather than reliance on paper systems, which could not keep up with clinical and managerial requirements for quick access, interpretation and storage of data (Bates *et al.,* 2003; World Health Organisation 2005).

Corrigan *et al.,* (2001) argued that health information technology can not only detect an adverse incident, but also facilitate a more rapid response once an adverse incident has occurred. Corrigan *et al.,* (2001) stated that information systems represent a critical and underused tool for the deployment and management of adverse incidents. Despite this, Aspden, Corrigan *et al.,* (2004) reflected that there was still 'no agreement on a common data set for representing patient safety information'. Ross, Plunkett and Walsh (2010) reached similar conclusions after studying how incidents were categorized on electronic incident reporting systems across health boards in Scotland. The implication of this is that healthcare organisations are unable benchmark themselves against other healthcare organizations or identify trends across the healthcare system.

Leape (2002) argued that reporting systems have, 'dubious effectiveness in facilitating change'. Milch *et al.,* (2005) attempted to describe the rate and type of adverse incidents reported in an acute hospital using an electronic reporting system. The study involved twenty-six acute hospitals throughout the United States of America using different voluntary electronic reporting systems. The participants were hospital employees and staff. The findings were reporting rates which varied across hospitals and that registered nurses provided nearly half of the reports. Physicians were noted as only contributing less than 2%. Milch *et al.,* (2005) concluded that electronic reporting systems were an accessible method for reporting adverse

incidents. Milch *et al.,* (2005) called for more research into the wide variation in reporting rates among hospitals; the researchers also called for more research into why physicians' had low reporting rates. The potential weaknesses of this study are that there were different definitions of adverse incidents between nurses and physicians. The study also identified a limitation that different hospitals had diverse definitions and data collection methods. It was also noted that not all adverse incidents had been recorded and reported, making the findings potentially inaccurate.

There is widespread agreement that electronic reporting systems in healthcare have many benefits over traditional paper-based systems. Despite the benefits of adopting electronic reporting systems in healthcare, general problems associated with reporting incidents may still be prevalent. For example, Bates *et al.,* (2003) argued that some hospitals have been under-reporting the number of adverse incidents. Anderson (1999) agreed that computerised systems are not only part of the overall solution in preventing adverse incidents, but that the process of reporting and interaction needs to be significantly improved. The level of under-reporting in healthcare is difficult to establish (The Institution of Medicine, 2001). Electronic reporting systems appear to overcome some of these limitations, but specific barriers associated with electronic systems have yet to be investigated across clinical and managerial professions within an entire healthcare organisation.

2.2.1 EAIRRS in different health specialities

Holden *et al.,* (2007) have documented that a number of reporting systems have been introduced in different healthcare specialities. Medical specialities such as pharmacy, anaesthesia and laboratory work have developed their own technical data-bases to record and monitor adverse incidents. Anaesthesia developed their own electronic Anaesthesia Information System (AIMS) to record their own department's speciality adverse incidents. The AIMS is used for the comparison of manually recorded adverse incidents only within their department. Benson *et al* (2000) compared an AIMS with manually recorded adverse incidents from anaesthesiological procedures such as hypertension, bradycardia, tachycardia and hypervolemia. Benson *et al* (2000) concluded that the support of the AIMS automatic

detection technology 'proved' significant deficiencies in the manual documentation of adverse incidents.

Benson *et al.,* (2000) however did not consider the implications of data ownership that came from the increased levels of reporting from the electronic reporting system. The data from the electronic reporting system was only seen and used by the clinical speciality department involved and not disseminated throughout the organization to promote shared learning. Traditionally, reports made on the paper-based system were collected and analyzed centrally through the organization's health and safety department. Another limitation of Benson *et al.'s* (2000) study is that the clinical speciality departments were using different reporting systems with different coding and reporting structures. Thus, it is unclear what barriers may be encountered in using an electronic reporting system on an organisation-wide in acute healthcare.

2.3   Barriers to implementing and sustaining reporting systems in healthcare

With the repeated calls as shown in section 2.2 for the use of technology in healthcare, there are, nevertheless, barriers to its adoption (Garrett *et al.,* 2009). This section reviews studies about barriers to implementing electronic reporting systems in healthcare settings.

2.3.1 Technology

Bates (2002) in arguing the case for information technology in healthcare, concluded that healthcare organisations invest less in information technology than any information - intensive industry. He concluded that current systems are 'relatively primitive' compared to aviation. However he summarised in his report that information systems would be helpful if the question of standards, security, confidentiality, professional involvement – which are important 'levers' – was properly addressed. The report highlighted these barriers but did not provide any potential solutions to overcome the barriers in order to achieve the 'vision of the future'.

Implementing new technology systems has been seen to be difficult and challenging. There is limited knowledge about the use of technology in its electronic form as a method of reporting adverse incidents and further research is required to fill the gap (Dick *et al.,* 1997; Berg, 2001; Ammenwerth *et al.,* 2003; Kelcun *et al.,* 2005; Ashcroft *et al.,* 2006). Despite this, there are numerous technical reporting systems that exist in healthcare and their use varies both in approach and access (Thomas *et al.,* 2003). On reviewing the literature each different aspect of reporting and recording has been studied and these have identified a reporting system a number of common barriers and themes.

Johnson (2003) argued that the lack of technological development has been largely a result of poor user interaction such as completing the forms, fear of being blamed and time constraints rather than software manufacturer. The development of these EAIRRS has also been hampered by the lack of computerised and knowledge skills by users. This has affected the design, storage and presentation of the information. Current literature has concentrated on human factors which have caused human error in terms of slips, lapses and mistakes, but not on the adverse incidents reporting system's ability to meet organisations' requirements in relation to patient safety (Vincent, 1989**;** Bates; *et al.,* 1997; Berwick, 1998; Leape, 2000, Johnson, 2002).

Bates *et al.,* (2003) recognised that most healthcare organisations rely on unprompted reporting to detect adverse incidents and recommended information technology in order to detect adverse incidents in a timely and cost-effective method. The benefit, in their opinion, of using technology which could assist in detecting adverse incidents would be to help to prevent patient harm. The researchers undertook a structured review of studies (in English) on using information technology to detect an adverse incident. The research concluded that technology was more beneficial than relying on a manual system approach. The limitation of this research is that the reviewers had to abstract the information as described by the authors. The research findings relied on the reviewers identifying the information required. However only twenty-five studies were reviewed and it was recognised that further research would be required as technology further developed.

2.3.2 Data analysis and data collection

Cohen (2000) further argued that to improve patient safety via reporting, it should be supported by strong well designed systems for analysis and response. In order to achieve this Cohen recommended that, 'reporting systems should be managed by an independent, multidisciplinary expert body that can objectively determine the system based causes of errors and promote effective change'. The limitation of this is that Cohen provides no details or areas for further research or how this can be achieved.

Johnson (2003) reviewed the problems of analysis and classification of data and found that there were, 'poor user interface to many electronic reporting forms and the lack of computational expertise'. Johnson (2003) identified that database technology had been developed by human factors experts in order to classify the causes of human error. The limitation of this is that the data taxonomies constantly change and the concepts between human factors have altered over time. From an organisational point of view the design technology has to be constantly updated, resulting in frustration and confusion. Johnson (2003) examined the cost which aviation Safety Reporting System spends as approximately $3 million annually in order to review 30,000 reports using electronic databases. Johnson (2003) equated this 'to £50 million to manually reclassify hundreds of thousands of reports to reflect a revised taxonomy.'

Johnson (2003) called for more research and to move away from human factor specialists but, rather, to use designers who can help clinicians and managers to enter complex adverse incident data. Johnson suggested a move away from learning from other industries such as aviation and nuclear as patient safety organisations such as hospitals need to invest both in technical and socio-elements to reporting.

2.3.3 Leadership and blame

Heifetz (1994) argued that leadership and its associated roles have a key responsibility to direct attention to healthcare professionals, including physicians, to the issue of adverse incidents. Reinertsen (2000) reflected that 'healthcare leaders and managers would feel personally responsible for error tend to blame individuals

at the sharp end of the error'. Woods *et al.,* (1994) argued that leaders should take personal responsibility for the processes and systems in which individuals work within their organisation.

On this basis Woods *et al* (1994) argued that a significant proportion of the board and management agenda would be devoted to achieving this goal. Despite these generalised comments, no framework is provided as to how this is to be achieved and measured in order for organisations to declare a reduction in adverse incidents. This is not an effective measurement to effective reporting as Cullen *et al.,* (1995) argued that, 'reported error rates would go up for a while, since we currently under-report errors and near misses by a factor of 10'. Cullen *et al.,* (1995) reflected that organisations would feel very positive with an increase in reporting of adverse incidents on a proper recording system. The possible limitation of this response is that organisations may not be aware of the extent of adverse incidents occurring. Reporting and recording systems may be an aid to uncovering the degree of the patient safety problem across an organisation.

The National Audit Office (NAO) (2005) reported that the main reason why junior doctors did not report adverse incidents was because of the complicated and lengthy reporting process. This coupled with the 'heavy workloads of junior doctors suggest that means that many doctors simply do not report an adverse event' (National Audit Office, 2005; House of Commons Report, 2009). Despite this statement the report recognised the risks to patient care, but had no formal influence to make a change to workloads and pressures under which medical staffs were working.

Garrett *et al.,* study (2006) argued that technology when carefully implemented can improve medication incident reporting. This study only researched into the use of medication error data using the new technology over a one year period. These findings emphasised the importance of preparing staff for the use of the technology and the inclusion of the end users which may impact on the success or failure of the introduction of the new technology. The potential weakness of this research is that it concentrated on data collection from the system and only specifically medication incidents

Health care professionals and groups require feedback on patient safety issues highlighted by the use of technology. Clinicians need to see the practical benefits in relation to saving time, the effective use of staff and evidence of improved patient outcomes (Uribe *et al.,* 2002; Jeffe *et al.,* 2004).

2.3.4. User groups' attitudes to reporting

The reporting and recording literature has shown that there are significant variances between physicians and nurses and between levels of seniority within the same groupings (Holden R.J and Tzion Karsh B. 2007).

Cultures vary greatly and in health there is no single culture but a fragmented collection of occupational cultures such as medicine, nursing and management. There are also subcultures and fragmentation within, such as surgery, pharmacy, finance and performance (Carrol *et al.,* 2004).

Lawton *et al.,* (2002) argued that staff are reluctant to admit to making a mistake, or reluctant to appear foolish or incompetent. They reflected that staffs also appear uncertain as to how report an incident. The fear of litigation and worrying about reprisals and job security can also play their part in poor reporting levels. The potential shortcoming of this is that no clear definition is used to describe 'reluctant' and gives no reason for the cause and effect on reporting. Combined with this it is unclear or unknown the ratio of non-compliance to reporting.

Leape, (2002) argued that the rates of reporting of adverse incidents have traditionally been low because of the fear of being discovered or because of the fear that disciplinary action will take place against groups or individuals. This has been a factor affecting the willingness to report. Despite this view Leape argued that 'research of the usefullness of reporting programs is limited.' Leape also reflected that the impact of reporting systems is not known and called for more research to be undertaken.

Lawton and Parker (2002) undertook a study to investigate the willingness of healthcare professionals to report the mistakes of others. They made use of a

questionnaire approach using nine short scenarios. Each scenario was presented with a good, poor or bad outcome for the patient. The participants were doctors, nurses and midwives. The findings of this study suggested that doctors are reluctant to report an adverse incident to a superior. Its conclusion was that organisational learning should rely on failures before they happen rather than after an adverse incident has occured. The limitation of this study is that healthcare staff may answer the short scenario exercise as to what action would be ideal and expected.

Harper and Helmreich (2005) compared aviation to healthcare reporting systems, concluding that studies have indicated that physicians are reluctant to participate in programmes to report medical errors. A survey approach was undertaken and two issues were identified;

(1) the power of nonpuntive process, and

(2) the importance of a systematic focus. (Harper and Helmreich 2005).

On comparing aviation with the survey findings, the main conclusion was a no-blame approach to reporting should be used. Harper and Helmreich also concluded that under-reporting may be as high as 96 percent. However it is difficult to assess if this figure is correct from the study.They also concluded that the success of any adverse incident reporting system, 'is determined by the attitutes and perceptions of frontline care providers.' Harper and Helmreich (2005) highlighted that prior to any implementation of a reporting system, an assessment of the opinions of healthcare staff should be conducted to identify critical barriers to reporting. The limitation of this study is that, despite the findings, it provided no framework in order to improve the level of reporting from healthcare staff.

Kingston *et al.,* (2004) undertook a study to examine the attitudes of medical and nursing staff towards adverse incident reporting and also to identify measures to facilitate incident reporting. Fourteen medical and nineteen nursing staff were recruited using a purposive sampling from three metropolitan public hospitals in Adelaide, South Australia. The findings identified cultural differences between doctors and nurses and that nurses reported more than doctors. It was proposed that nurses had directives and protocols, compared with a medical culture which appeared to be less transparent. The findings identified other barriers to reporting such as, 'time constraints, unsatisfactory processes, and deficiencies in knowledge,

cultural norms, inadequate feedback, beliefs about risk, and a perceived lack of value in the process.' Kingston *et al.*, (2004) concluded that strategies were required to improve incident reporting by addressing cultural issues. The limitation of this was there was limited suggestion as to what type of strategies should and must be used.

Cohen (2000) argued that, 'reporting will occur only if practitioners feel safe doing so and it becomes a culturally accepted activity within the healthcare community. Until health care embraces such a culture, practitioner reporting will continue to be an untapped resource'. The weakness of this is that it highlights some of the barriers to reporting, but provides no solutions or framework for overcoming or beginning to address these barriers. There was limited explanation for the fundamental reasons for these barriers and the potential cause and effect.

2.3.5 Lack of engagement

The IOM report (2001) 'Crossing the Quality Chasm' has shown that there are cultural rules or patterns of behaviour that characterise medicine today, along with suggestions for tomorrow's rules. Caroll *et al.,* (2004) argued that there is an emphasis with both visible behaviours and the more subtle values and assumptions underlying them. The House of Commons Select Committee (2006) made an observation that, 'Doctors are less likely to report an incident than other staff *gro*ups'. It was noted that the NPSA had conducted a number of national learning initiatives in order to encourage junior doctors to report adverse incidents and share lessons across the NHS.

Reinertsen *et al.,* (2007) stated that a critical factor in hospitals is that 'very little happens in the care system without a physician's order.' On this basis they argued 'that any changes in the way healthcare is designed and delivered requires physicians acceptance, either as individulas or as a professional body.' Davies *et al.,* (2007) stated that physicians have significant anxieties about the public sharing of individualised data on clinical performance. Reinertsen *et al.,* (2007) argued that hospitals have difficulty in generating enthusiasism with medical staff, who are challenenged by the demands of their daily professional lives, administrative burdens and overall decreased satisfaction.

Lawton and Parker (2002) in their study into the willingness of healthcare professionals to report verabally mistakes of others. Particpants to the research were predominately doctors and found that they are reluctant to report adverse incidents verably to a superior. Lawton and Parker (2002) concluded that an 'alterative means of organisational learning' needs to implemented. Lawton and Parker (2002) argued that proactive reporting systems should be introduced in order to identify 'failures before they give rise to errors that compromise patient safety' The limitation of this study was that it was conducted before adverse incident reporting were introduced. The study however highligted the potential reluctance of medical staff to report verably to their indivdual superiors. Lawton and Parker (2002) called for more research to be undertaken to see, 'whether the findings here can be generalised to other forms of reporting.' This research study helps to question if EAIRRS would improve medical reporting as relying on verbal process would have its limitations.

Figueiras *et al.,* (2001) also used a questionnaire based study among 692 physicians in order to assess their attitude towards and opinions in relation to adverse drug incidents. The findings concluded that voluntary reporting can be risky for the physician and crucial to improving this attitude was through educational strategies based on personal contact. The study did not provide any framework for improving clinicians' attitude but did recognise the importance of training and educational for improving voluntary reporting.

Cohen (2000) argued that widespread barriers to recording and reporting any adverse incidents fall mainly into three categories: 'fear of individual or organisational repercussions, the false belief that that medical error can be used as a measure of practitioners' competence; and potential legal discovery of error reports.'

Hamilton – Escoto *et al.,* (2006) researched the differences between physicians and clinical assistants in their preference for a medical error reporting system. A number of focus groups were formed, composed of eight physicians and six clinical assistants. The focus groups lasted one hour via teleconference lines and were conducted one or two times per month for nine months.

The findings concluded that, 'although physicians and clinical assistants shared similar preferences and beliefs surrounding error reporting, these were, 'differences including rules and regulations governing the use of the system if medical error reporting systems are to be effective'. Hamilton-Escoto *et al.,* (2006) concluded that, 'to successfully deploy a medical error reporting system, the system itself must be designed for the potential users.' The potential limitation of this research is that the number of participants was small and there is a potential that with a group setting participants would only say what may be seen as relevant.

Hart and Hazelgrove (2001) argued that there is a source of tension which exists between managers and doctors. This is potentially because of a lack of shared language which makes it difficult to arrive at a general consensus about how to monitor and evaluate medical practice. Electronic reporting systems could be seen as a management inspection and study into the way clinicians operate. Waring (2005) supported this view that, 'clinicians' fear that the information obtained may be used for 'ulterior motives or misinterpreted by managers lacking hands-on contextual experience.'

2.3.6 Accountability

Amalberti *et al.,* (2005) in a review of five systems to achieving ultra - safe healthcare suggested that healthcare needs to overcome three 'unique' issues,
1) a wide range of risks among medical specialities,
2) difficulty in defining medical errors and
3) structural limitations for example teaching and chronic shortage of staff.
The findings recommended a framework to guide development and efforts in order to improve patient safety. Amalberti *et al.,* (2005) summarised that, 'rapid progress is possible only if the health care industry is willing to address these structural constraints.' The drawback of this is that it recognises that a framework is required, but gives no indication what type of framework is urgently needed.

Holden *et al.,* (2007) reflected that system designers of reporting and recording systems must be aware that a number of clinicians may witness the same adverse incident. Holden et al described whether the organisation should encourage each

witness to report or develop a system for delegation to one person. This brings into focus the question of who is accountable for reporting an adverse incident within the reporting system. On the other hand Johnson (2003) argued that the limitation of this approach is that no-one would report and would provide, 'an unnecessary burden on clinicians'. This highlights the delegation and accountability issues surrounding reporting and recording. The delegation of reporting may create an unfair distribution of accountability as physicians delegate the responsibility to nurses (Kingston *et al.,* 2004; Hamilton-Escoto *et al.,* 2006).

Vincent (2010) reflected that leadership at all levels within an organisation can be seen by setting up committees and initiatives. Vincent (2010) argued that staff need time to be engaged in in the redesign of systems and processes. Leaders are important to influence, demonstrating the value and being willing to discuss issues.

These types of strategic and operational leadership are important requirements in issues surrounding patient safety (Barling, *et al.,* 2002; Flin and Yule, 2004).

Ennis and Harrington (1999) argued that managers within healthcare need to strengthen accountability for quality, but they also need to pay attention to the different ways of empowering staff with devolved authority to make changes to improve quality. Ennis and Harrington (1999) argued that 'responsibility for leading the quality effort must be shared equally between professionals and management.*'*

Bogner (1994) highlighted that decision support is required with an electronic record if adverse incidents were to be avoided. There is a danger that the electronic system information decides and acts automatically with no human interaction and this could be seen as threating with the potential loss of healthcare autonomy (Sheridan *et al.,* 1994).

2.3.7 Communication and feedback

Communication and feedback to staff is believed to influence participants' involvement in the reporting and recording process. There needs to be a viable benefit to reporting for the individual and the organisation. The IOM Report (2001)

which became the focus for health organisations to look at their systems and processes argued that, 'reporting without analysis or follow up may even be counterproductive in that it weakens the support for constructive responses and is a waste of resources. Poor information obtained from the system can provide no perceived benefit to the reporter or the health system'.

Gallagher *et al.,* (2003) in their study's objective to determine patients' and physicians' attitudes about error disclosure, undertook thirteen focus groups, with six groups of adult patients, four groups of academic and community physicians and three groups of physicians and patients. A total of fifty-two patients and forty-six physicians selected. The main outcomes were that patients wanted disclosure and all information associated with adverse incidents. The findings suggested that physicians agreed that disclosure and communication with the patient was important but, 'choose their words carefully.' Concern was expressed that 'physicians worried that an apology might create 'legal liability'. The limitation of this study, despite further insight into concerns from physicians in relation to disclosure, was that patients were concerned of the quality of the service e.g. physicians being rude to patients. Despite providing with a standard definition of an adverse incident, participants may have brought into the research their own experiences in relation to the service. For example with the findings it was noted that, 'physicians were frustrated by the breadth of what patients considered to be errors and thought patients were often unduly upset about , "minor" errors'.

2.4 A Socio-Technical Systems Approach

The section above reviewed key studies about barriers to electronic incident reporting. These studies focussed on one of two main barriers: technical barriers or socio barriers. Technical barriers identified in the literature were: technology, and data analysis and data collection. Socio barriers identified in the literature were: leadership and blame, user groups' attitudes to reporting, lack of engagement, accountability, communication and feedback. Although comprehensive, these barriers may not be exhaustive, and were identified through studies which were limited to hospital departments or medical specialities. Thus, it is unclear what barriers are associated with implementing and sustaining an EAIRRS in an acute healthcare organisation, which is the research question under investigation.

Leape (2002) unwittingly argued that for any reporting system to be effective, socio- and technical elements need to be taken into account. He did not however provide any framework in which these socio and technical elements could be considered. The remainder of this section makes a case for adopting a socio-technical systems approach to studying EAIRRS as this approach considers both socio- and technical elements concurrently, and to date such a framework does not exist.

Cumming and Worley (2001) described the term 'socio-technical' in, for example, an organisation, made up of two sub-systems,
1) a human part (the people and their relationships) and
2) a technical part (the tools, procedures and accountabilities), that will guide and measure job performance.

Cumming and Worley (2001) argued that, in order to measure the efficiency of organisational change, data is used to measure the effects of change both the socio- and technical elements. This intelligence according to Cumming and Worley (2001) can feed back to the organisation which may lead to new change and action.

Pasmore *et al.,* (1982) described the socio-sub-system as the human element of the organisation capable of innovation and adaptable to change. Pasmore *et al.,* (1982) also defined a micro-level of this socio-sub-system with characteristics such as

motivation, group performance, communication, flexibility, autonomy, communication, satisfaction interaction and involvement. The macro level of the socio-sub-system consists of organisational culture and design.

The technical sub-system embraces the tools, knowledge base and the technology required to achieve the organisation's aims. The technical sub-system affects the work design, self-perceptions, relationships between departments, organisational structure, organisations flexibility and productivity of the change required (Pasmore *et al.,* 1982). Socio-technical approaches refer to an organisation's performance which can be highlighted with the inter-dependency of the socio- and the technical elements of the organisation; with ways in which these two elements can work more efficiently together. Mumford (2003) argued that if a technical sub-system is being designed, the objective must be the 'joint optimization of the socio and technical systems'.

Cherns (1976) argued that by designing a system which is capable of adapting by using the creative knowledge of individuals and/or groups will help to assess the success and effectiveness of the quality of the design. Coiera (2006) argued that socio-technical systems provide a strong framework to analyse the reasons or poor acceptability and performance of the system. This socio-technical approach can contribute to assessing current practices and developing new information systems (Coiera 1999, 2006).

Cherns (1976) also explored that in order to assess the effectiveness and efficiency of a socio-technical approach, users' input and interaction is required in order to capture the following:
- absolute essential criteria required to capture the data,
- defined critical tasks to jobs,
- defined roles, responsibilities,
- competencies required, and
- constant interchange between designers and users.

Cherns (1976) claimed that having criteria and defined roles and responsibilities is required for any new system. The potential weaknesses in this view lie in introducing a new system into any organisation; roles and responsibilities may not already be well defined. New systems may not have well defined essential and desired criteria within the organisation for the introduction of new technical system as in an information system. New competencies may not be recognised earlier in the design and implementation phase. This may be because technical system designers may have predominately concentrated on the technology and not on the application. Cherns (1976) relied on the constant interchange between the system designers and users' interaction in order to improve performance. One potential weakness of this approach is that an already designed system from 'off the shelf' may have limited room for local adaptability.
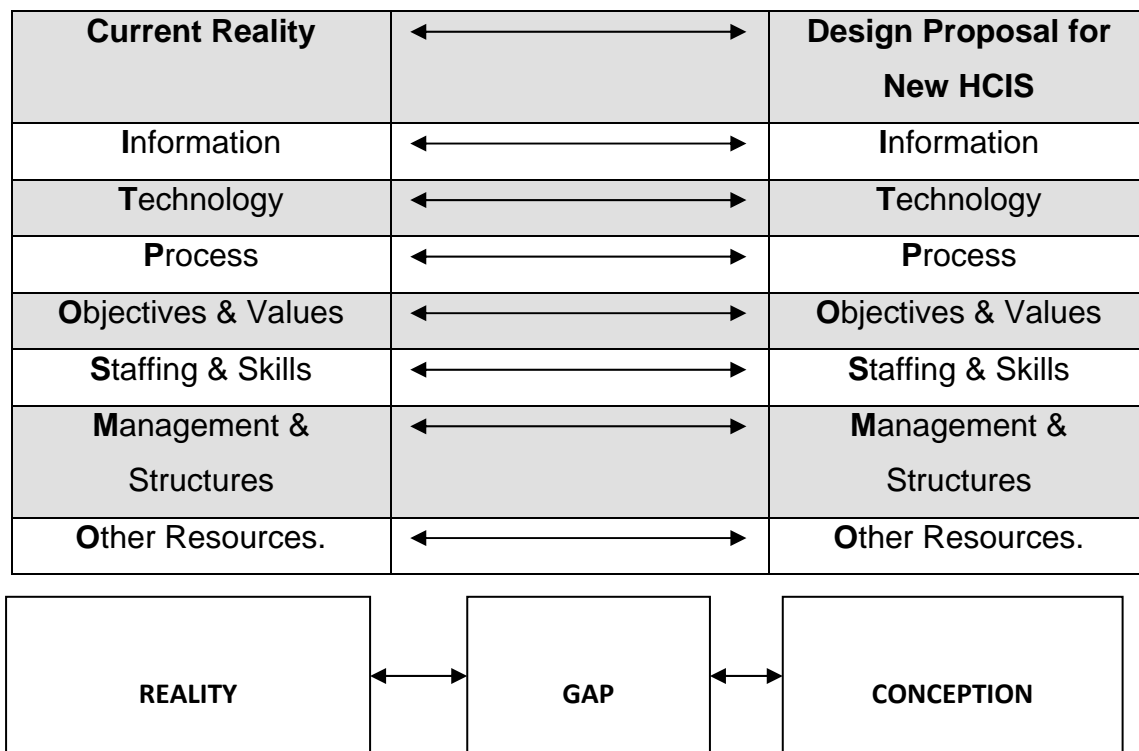
2.5   Heeks's ITPOSMO Model

Heeks (1999, 2001) used a socio-technical systems approach as the basis for his model for evaluating the implementation of commercial information systems into organizations.   Heeks (1999) ITPOSMO (Information, Technology, Processes, Objectives and values, Staffing and skills, Management, Other resources) model identified seven socio-technical factors but was more concerned with explaining the design-reality gap. The remainder of this section shall describe Heeks' (1999) model and then a case will be made for why it was adopted to investigate the research question.

The purpose of Heeks' (1999) ITPOSMO model was to identify the design-reality gap in an information system. The concept of reality can be the result of different individuals and social groups having different views and approaches. These views and experiences will build up over the system's life-time and will shape the success and limitation using the new technology (Geels *et al.,* 2004).   This multi-user perspective of the new commercial system will be discussed in the research methodology in Chapter 3.

The model primarily focuses on the design phase of the information system under examination. Heeks *et al.,* (2000) emphasised that undertaking such an examination helps to identify the risks that the information system might develop. The model posits that gaps can exist in the following areas:

1. **Information:** Public hospitals tend to place emphasis on financial cost information and more emphasis on broader performance.
2. **Technology:** Hospitals tend to have more limited and older technological infrastructure because of different regulatory requirements.
3. **Processes:** Management and clinical processes are both different following different funding arrangements.
4. **Objectives and Values**: Finance maximisation and increase in patient flows appear to be the primary goal. There are also different values from different groups/professions in relation to patient safety.
5. **Staffing and Skills:** Public hospitals have fewer nursing staff and fewer technology- related staff.
6. **Management and Structures:** Hospitals tend to have weaker non-clinical management structures.
7. **Other Resources**: Hospitals tend to have less money than the private sector.

The design reality gap between these seven socio-technical dimensions in Heeks'
(1999) model is shown in Figure 2.1.

Current Reality	⟷	Design Proposal for New HCIS
Information	⟷	**I**nformation
Technology	⟷	**T**echnology
Process	⟷	**P**rocess
Objectives & Values	⟷	**O**bjectives & Values
Staffing & Skills	⟷	**S**taffing & Skills
Management & Structures	⟷	**M**anagement & Structures
Other Resources.	⟷	**O**ther Resources.

REALITY	⟷	GAP	⟷	CONCEPTION

Figure 2.1: The ITPOSMO Model Dimensions of change healthcare information
system proposals.

Source: Heeks, Mundy & Salazar (1999) Why Healthcare Information Systems
Succeed or Fail. Institute for Development Policy and Management, University of
Manchester.

In order to identify the reality gap as described in Heeks's (1999) Model, there is a
potential weakness that different socio-groupings will have differing views on the
current (reality) success or failure at a given time. Berg (2001) argued that, 'success
of failure or anything in between' is subjective. Berg also argued that some health
organisations might continue with the technology - despite perceived problems on
conception - or others may decide to close down the project depending on whether
implementation has been unsuccessful following users' experiences or the project
has been poorly managed in the development (design) process (Woolgar, 1988.,
Bijker, 1992., Kaplan, 2001).

2.6   Justification for adopting Heeks's Model

The literature reviewed in this chapter has identified socio barriers and technical barriers associated with electronic reporting systems in healthcare. These studies however have been limited to specific specialities or departments and have not investigated these barriers across an entire acute healthcare organisation. Moreover, the literature has not posited a framework in which to consider all of these socio and technical barriers but Leape (2002) unwittingly argued for a socio-technical systems approach for incident reporting in healthcare. Heeks' (1999) proposed a socio-technical systems model to evaluate the implementation of information systems into organizations.   His model allows for the investigation of users' perceptions along seven dimensions (Information, Technology, Processes, Objectives and values, Staffing and skills, Management, Other resources). These seven dimensions are consistent with the socio and technical barriers identified in the literature earlier in this chapter.   Thus, Heeks' (1999) model serves as an appropriate starting place for investigating the research question.

2.7   Chapter Summary

This chapter has outlined the barriers to implementing and sustaining an electronic adverse incident recording and reporting system in acute healthcare. This chapter also reviewed the literature on socio-technical systems and has made a case for adopting a socio-technical systems approach for investigating the research question. Heeks's model which was developed to evaluate the implementation of information systems in organizations was chosen as the conceptual basis for the research. In order to address the research question, **'What are the barriers to implementing and sustaining of an Electronic Adverse Incident Reporting and Recording System (EAIRRS) in an acute healthcare environment?'** the literature suggests that both technical and socio factors need to be considered**.**