A Soft Approach to Survey Design

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Abstract

The healthcare sector is a large, complex and information rich environment. For many years Information System professionals have developed systems which attempt to meet the information needs of the stakeholders. A key item, which has recently gained prominence, has been the need for a comprehensive set of I.S. standards. In particular, considerable activity by organisations such as C.E.N., I.S.O. and the HL7 Foundation has been directed towards the development of standards for the storage and exchange of clinical information. This paper discusses a novel approach that was used to gain a better understanding of factors which influence the adoption of I.S. standards within healthcare. The approach utilised aspects of Soft Systems Methodology and conventional survey methodology to gain a better understanding of the processes involved in developing and adopting standards. This understanding was then used to guide the development of a questionnaire which was then used to elicit further information from the stakeholders.

Introduction

This paper discusses the way in which some of the techniques of Soft Systems Methodology (SSM) was used in research which aimed at gaining a better understanding of the issues involved in the development and introduction of standards for Electronic Medical Records (EMRs) to record the treatment of patients. The paper begins with an overview of SSM and how it was used in this project. The paper than discusses some of the background issues relating to the domain of EMRs and I.S. standards and shows how the use of SSM helped the researchers to gain a better understanding of the issues.

Soft Systems Methodology

Soft systems methodology was developed with the specific intention of addressing complex issues associated with human activity systems. It has been applied with success in a number of areas: public utilities, health services, industry and education (Watson and Smith, 1988: Checkland and Scholes, 1990). A key feature of SSM is that it enables the analyst to embark on a process of learning about the domain under scrutiny and seek ways of improving the problem situation.

The methodology is described schematically in Figure 1 as a three phase process (Identification of issues and tasks, Modelling possible ways of improving the problem situation, Taking action that is culturally desirable and feasible). However, it is important to stress that each problem domain is unique and the three phase cycle may not be appropriate.

1. In the first phase, the would-be improvers enter the problem domain and attempt to understand and describe the problem situation. It is expected that the need for intervention has been flagged by some prior experience or analysis (History). In this Finding Out phase the key players, and their roles, are identified together with a list of issues thought to impact on the situation. The results of the Finding Out phase are frequently represented in a Rich Picture. Such a picture is likely to bring together the structural and dynamic features perceived relevant by the players within the domain.

2. In the second phase, issues thought relevant to the problem domain are then subject to two streams of enquiry. A logical stream of enquiry is carried out which attempts to seek ways of addressing the issues by developing systems, definitions and models (hypothetical) that might be applied to the problem domain, and a cultural stream of enquiry which modifies, reflectively and dynamically, the logical stream by bringingto bear factors associated with the social and political characteristics of the domain. The cultural stream brings into play the roles, norms and values of the stakeholders and the other players associated with the situation.

3. In the third and final phase, SSM concludes with a set of proposals for feasible and culturally appropriate action for change with a view to improve the problem situation. Of course, there is an implication that the process is cyclic and as such is a neverending process of learning and improvement.
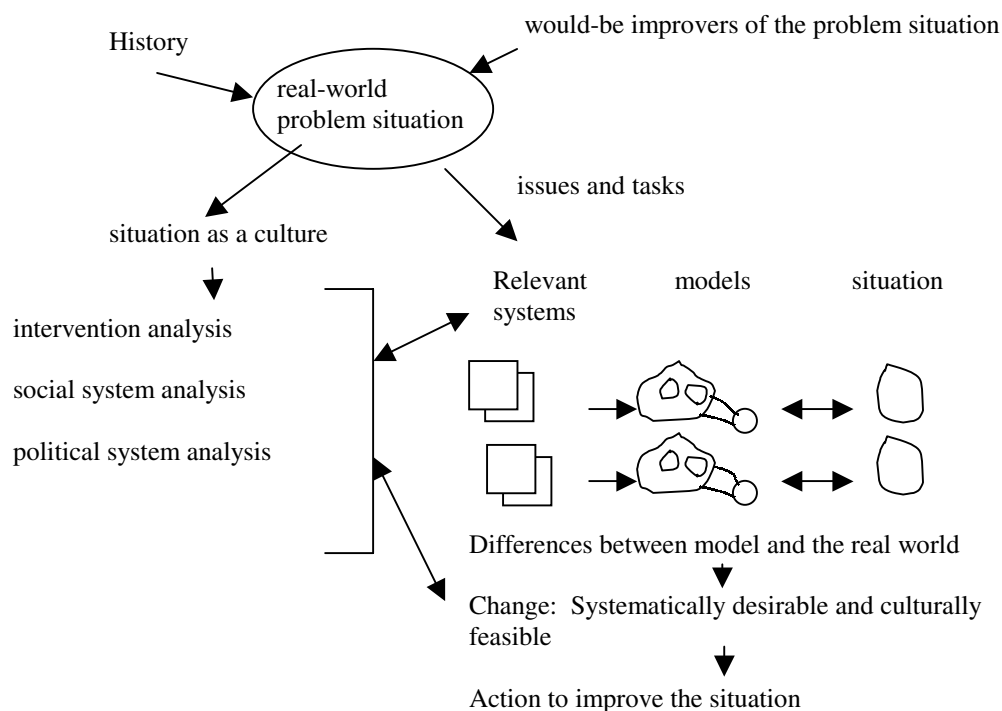

Figure 1: Soft Systems Methodology (Checkland & Scholes, 1990)

Application of SSM to the problem domain.
In seeking to develop Electronic Medical Record standards the researchers felt that there were four key areas of activity where the application of soft systems methodology could be useful:

- Gathering of pertinent historical data relating to EMRs
- Identification of key issues concerned with the introduction of IS standards.
- Identification of key players in the problem domain, their roles and values
- Development and format of questionnaires that encourage the recipients to respond in a meaningful and responsible manner.

Each of the above areas require an appreciation of not only the key issues but how they reside within the wider culturally rich external environment. In essence each is a separate problem and could be supported by the separate application of SSM, however, only the top-level application of SSM is described here. The steps taken relate to the first two phases of SSM, the outcome for the third phase is yet to be developed.

Historical data

Most human activity problems have associated with them a history of success and failure and the development of Electronic Medical Records is no exception. As shown in Figure 1, SSM begins by drawing together the various, and often wildly/widely conflicting, historical accounts relating to the problem domain. In this investigation the principal source of 'history' was the literature review and the knowledge of experts in the field. This history is discussed below in the "Context" section below.

Key players

These perspectives were gathered from a range of sources primarily through the use of a literature review. Care was taken during this phase to ensure that perspective from a wide range of actors were obtained. Entering the problem domain with the intention to improve the situation are the analysts who bring their own perspectives and opinions. The researchers identified, through detailed examination of the literature reviews and knowledge of the healthcare community, those actors within the problem domain whose contribution would be meaningful and valuable. Such participants are not passive but have opinions, perspective and motives that differ from one another and can often dominate the debate. The participants operate within their own social, political and cultural environment and may have quite distinct roles, values and norms to each other.

Issues

A rich picture of the problem domain was drawn. Such a picture not only captures the basic formal structural relationships between the various actors but also the social and political undercurrents. The rich picture also defines the boundary of the problem domain excluding those organisations and people who are outside the domain but who behaviour impact upon the problem but includes those groups whose behaviour can be influenced and modified through discussion and debate. The rich picture stimulated debate and discussion which led ultimately to formulation of a list of issues and primary tasks that need to be resolved. (Note: In SSM an issue is concerned with the ability of the system to develop a 'solution' in an effective and efficient manner. A primary task consists of those activities that must be completed for the system to achieve its goal.)

The key issue for this project was to identify what the key players thought were characteristics of a good standard. However, since there were a lot of key players, it was decided that the most appropriate approach would be to conduct a survey, which is a novel approach for SSM.

Questionnaire
The successful distribution and analysis of a questionnaire was deemed essential by the researchers. It became apparent that there was no 'typical' respondent and that care needed to be taken to design questionnaires for specific target groups. For each target group a questionnaire was constructed that respected the respondents' level of understanding of the problem domain and their roles and values within the wider health sector environment.

The following sections of this paper will illustrate the process by following the evolution of the project .

Context of Healthcare and the Pressures for Electronic Medical Record Standards

The delivery of healthcare services is an inherently complex task. It involves the interaction of many of the natural systems of the patient with the scientific tools of diagnosis and therapy of the physicians. These interactions often involve multiple actors and are extremely information intensive and often time-critical. For many years now the healthcare industry has been struggling to use IT to manage the vast amount of data that constitutes the medical records of patients. The difficulties in developing systems arise from the fact that the information is poorly structured, it involves many different media (test results, X-rays etc) and it gets distributed around the country as patients move, change doctors or are referred to different hospitals. Issues of privacy, confidentiality and the legal status of the record further complicate the problem.

The delivery of care takes place within the complex political and economic environment of healthcare delivery. Throughout the course of a clinical episode the patient may be under the care of many clinicians working within primary, secondary and long-term care institutions. They may use facilities of other parties to provide laboratory and radiological investigations and be treated with drugs from pharmacies. The payment for these services may come from a number of sources, in New Zealand these might be private health insurance or throught the government bodies such as Health Benefits LTD (HBL) or the Accident Compensation Corporation (ACC).

In recent years there has been a considerable degree of change introduced into the New Zealand Health Sector (NIPB, 1992; NZDoH, 1990; NZMoH, 1991, 1992). The main emphasis of these policy changes is resource management, which has separated the funding of health services from their provision; introduced contestability into the process of allocating resources; increased the private supply in the market and increased the interface between former state health service providers and new private sector providers.

These desired changes are similar to the ones proposed in the United Kingdom (UKDoH, 1989) and in Australia (NHSU, 1993). This period of change has had a major impact on the development of health information systems (HIS), since there is now increased pressure to obtain of more timely and accurately management information.

The introduction of Independent Practitioner Associations (IPAs) into the New Zealand primary healthcare arena has increased the awareness and need for general practice to be computerised. This has been a 'push' towards increasing the electronic

transfer of data between the GPs, the IPAs and the Health Funding Authorities and other government organisations. There is also considerable political pressure to improve the efficiency and effectiveness of the health service by increasing the integration of the primary and the secondary care sectors. Improved communication and information flow has a major part to play in this integration. Electronic transfer systems, which involve computer linkages between providers, are being considered as a way of implementing this integration.

The basis for these transfer systems is often seen to be and integrated patient-oriented record system (or electronic medical record – EMR) which integrates all of a patient's medical, administrative and financially related information. This approach was recommended by the Institute of Medicine of the National Academy of Sciences (Dick and Steen, 1991) which identified EMRs as priority the improvement, efficiency and cost-effectiveness of the health services. They argue that EMRs should also provide better clinical decision support, aid in the monitoring of the quality of care and of services and provide more complete information for research.

Despite the long-acknowledged need for EMRs, unfortunately, there are a number of barriers to their increased adoption, both in primary care and secondary care. Some of these barriers include the lack of national and regional direction, co-ordination, planning and advice and the lack of the provision of the required infrastructure including the policies, standards, networks and communications.

In resonse to the need for standards there has been considerable activity by organisations such as the European Committee for Standardisation (C.E.N.), the International Standards Organisation (I.S.O.) and the Health Level 7 Foundation (HL7) directed towards the development of standards for the storage and exchange of clinical information. Within New Zealand, activities in this area are undertaken by a number of working groups which are coordinated under the Health Information Standards Committee of Standards New Zealand.

The members of these working groups find themselves at the center of nexus with competing demands. They need a better understanding of their clients needs in order to prioritise their efforts and maximise benefits they can deliver with the limited resources that are available for our local standards development initiatives. What the standards developers really needed to know was:

What are important characteristics of standard that impact on its chances of adoption? i.e. what constitutes a good standard?

What Constitutes A Good Standard?

Time seems to be one of the major faults of standards; they either take too long to create (Aiken and Cavallini 1994, Gritzalis 1997 and Scott-Hill 1996) or they don't remain useful and applicable within the desired arena for a long enough time frame. This means, that people are spending considerable time and cost creating standards, and they are in turn, being rendered useless. Cargill (1998) states that the participants in standardisation activities must realise that they are not there to protect the standardisation process; they are there to get standards out. These standards must be deployable by, and useful to, businesses that are producing products. "Perfect

standards two years late are worthless; tremendously imperfect standards are also worthless."

Morrell and Stewart (1996) take a somewhat different stance and present a list of problems that can occur when utilising or up-taking standards. Some of these include:

- The standards-making world is subject to strong forces over which it has little or no control, including de facto standards, new technologies, national positions on trade policy and the market positions of existing vendors.
- Most company representatives to standards committees approach their task from a technical rather than business perspective.
- Representatives to standard groups are often 'volunteers' rather than in dedicated paid positions which militates against the rapid development of standards.
- The work of different standards groups is often related, but those relationships are not always recognised. To complicate matters, the fusion of various technologies may generate connections between previously unrelated standards.

Oksala et al (1996) raise an issue, which few other articles have. They note that standards are developed within a cultural milieu. Standards are developed by a community that has a set of values and a particular perspective on information technology. The people, developing and using the standard have a long involvement in their particular field and the paradigm of the field may work as a kind of selection paradigm.

This is very important as it is acknowledging that although standards are for use (ideally) everywhere, standards may often be created, with a specific environment (indeed, their own environment) in mind. It may, in some situations, be far too hard to try and understand what another company, competitor, or even country will be using, or doing with the same tools. Indeed this is one of the problems of standards development.

Hovenga, Kidd and Cesnik (1996) briefly discusses this point by noting that the adoption of standards may be mandatory or voluntary, and various types of standards exist. The type of standard is determined by who has developed or adopted the standards or by the purpose for which the standards was developed.

Cargill (1998) depicts standardisation as running on urban myths; elaborating on the idea that there is no coherent, widely held and widely accessible body of literature on the nature, rationale, or practice of standards. There are no standards for standardisation. Cargill (*ibid.*) continues that standards are the fundamental agents of change, and yet the knowledge of how they work, inside the discipline and the market, is only vaguely understood. Until this vague understanding is made into a coherent knowledge base, standards will continue to exist in the twilight realm.

Aiken and Cavallini (1994) continue this point and were one of the few authors willing to admit, that they themselves are sure of the need for standards, yet find that they have no agreement about a number of basic issues, like the following:

- How to identify which standards exist and which need to be developed and enforced?

- How should standards be chosen? To what extent should the choice be influenced by industry, or the purchasing power of the federal government, or the actions of formal standards bodies and consortia?
- Who are the people actually developing and mandating the standards? Do they have real-life operational experience in the area they so greatly influence?
- What are the professional and ethical responsibilities of those persons who set standards? Are short-term cost benefits and conformity more important than diversity and competition?
- Should multiple standards be allowed to coexist? For example, at the network layer, are IP and OSI allowed to coexist?
- What is the real practical life cycle of a technology and/or standard and how is it phased out or replaced when appropriate?

It is indeed this list of questions that rest on the mind of many people when using standards. Part of the goal of this research project is to answer pieces of the first two questions, with regard to New Zealand healthcare.

The Standards Adoption Framework (SAF)
To ascertain which standards are selected over and above another standard, it is essential to set up a form of criteria. The literature presented many different sets of criteria, with many having common elements. The following section, lists the different criteria found, and presents the criteria that shall be used within the research.

Six relevant articles were identified with regard to evaluation criteria for standards. One of these articles, National Institute of Standards and Technology (NIST, 1998) presented a criterion that was used to evaluate a range of existing standards. The five other articles were giving a hypothetical list of questions that should be answered when selecting standards, these were: Batik (1989), Morrell and Stewart (1996) Oksala et al (1996), Baldo et al (1997), Aden and Harris (1993). It is the combining of these different forms of criteria that are used to formulate the underlying model of this research. The Standards' Adoption Framework aims to specify what individual elements are essential in the decision making process when selecting a specific standard.

It was decided that the combining of these would create the most useful model to work within. It is important to note that National Institute of Standards and Technology (1998) presents the most thorough criteria as this model has already been successfully used and accepted as a standard criterion.

Firstly, it was decided that it would be appropriate to pool the different questions (delete any identical questions), then group them into similar terms, and discover how they then relate to the NIST model.

This model is useful because it shows the individual questions in relation to the already tested and acknowledged NIST categories. It is important to note that once the groupings were made it became obvious that another category had to be appended to the NIST model. 'Interoperability' was important to the different literature pieces, but was not accounted for with the NIST model, consequently it was added as a specific category.

Another change was also created with the NIST model. In the original model 'Maturity' and 'Stability' were two separate categories, it was decided that it would be appropriate to combine the categories into one, as they were both concerned with the issue of time.

The final model, shown in Figure 2, called the "Standards Adoption Framework" (SAF) provides a general theoretical model which identifies and integrates the factors which are required for an IS standard to be successful, and therefore adopted.

In summary, the review of the literature related to standards revealed two main issues.

- Firstly, there are many criteria regarded as being important for the adoption of standards, which could be integrated into the SAF.

- Secondly, as Oksala et al (1996) noted, the processes of development and adoption of standards is located within a cultural milieu and the processes may therefore be influenced by a variety of stakeholders who may have differing priorities and perspectives on information technology.

Therefore, while the SAF provided a checklist of issues that needed to be addressed in standards development, it did not provide any guidance as to the relative importance and priority of these issues. Furthermore, it would seem likely that these issues are not generalisable and the priorities are likely to be different for the different stakeholders, and possibly the priorities may change for different application areas. Further empirical investigation was therefore required before the model would be able to assist the standards developers.
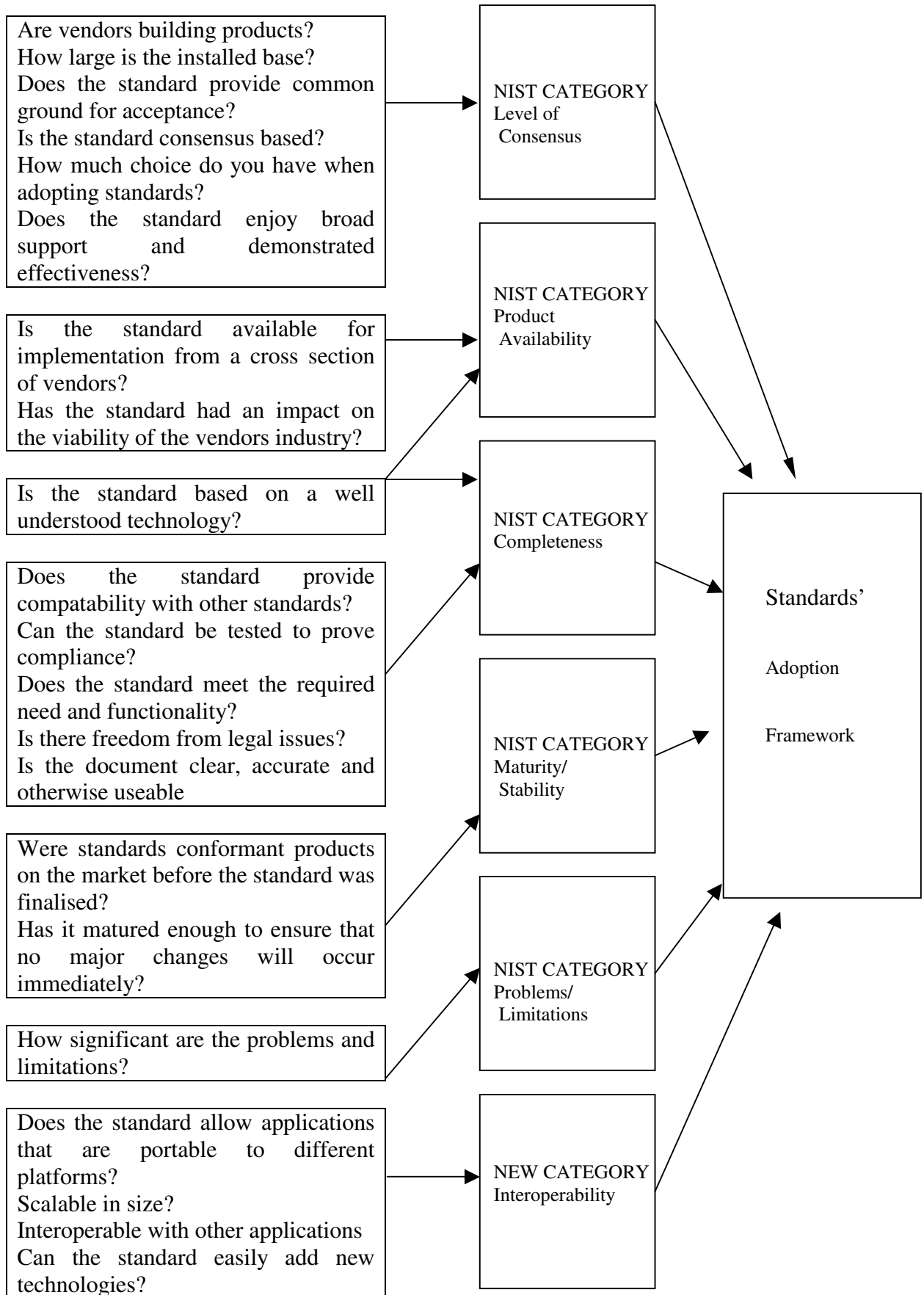
Refining our Understanding
As discussed in the previous sections, both the areas of healthcare and of standards development are very complex areas with many interested stakeholders who have different backgrounds and perspectives. It was felt that as far as the adoption of IS standards was concerned, one of the most significant stakeholders was the IS Manager since they would have considerable influence over the systems that are actually selected for deployment.

Whereas the main focus point is indeed the IS manager, it has been acknowledged that those around the manager also hold relevance and influence, and accordingly see standards in a different way. Soft Systems Methodology (SSM) allows for the concept that people have different views of the same situations because people see events occurring in genuinely different ways (Open University, Block IV). This can be represented graphically in a tool of the rich picture utilised by SSM. The rich picture for the IS Manager is shown in Figure 3 below.

Although the focus of the picture is the IS Manager, there still remain a number of people who can be considered as being relevant. This group of people include the equipment suppliers, the end users, the service providers as well as the information consumers (Ministry of Health, Health Funding Authority) to name but a few.

Are vendors building products? How large is the installed base? Does the standard provide common ground for acceptance? Is the standard consensus based? How much choice do you have when adopting standards? Does the standard enjoy broad support and demonstrated effectiveness?	→	NIST CATEGORY Level of Consensus
Is the standard available for implementation from a cross section of vendors? Has the standard had an impact on the viability of the vendors industry?	→	NIST CATEGORY Product Availability
Is the standard based on a well understood technology?	→	NIST CATEGORY Completeness
Does the standard provide compatability with other standards? Can the standard be tested to prove compliance? Does the standard meet the required need and functionality? Is there freedom from legal issues? Is the document clear, accurate and otherwise useable		NIST CATEGORY Maturity/ Stability
Were standards conformant products on the market before the standard was finalised? Has it matured enough to ensure that no major changes will occur immediately?		NIST CATEGORY Problems/ Limitations
How significant are the problems and limitations?		
Does the standard allow applications that are portable to different platforms? Scalable in size? Interoperable with other applications Can the standard easily add new technologies?	→	NEW CATEGORY Interoperability

Standards'

Adoption

Framework

Figure 2 –Standards' Adoption Framework
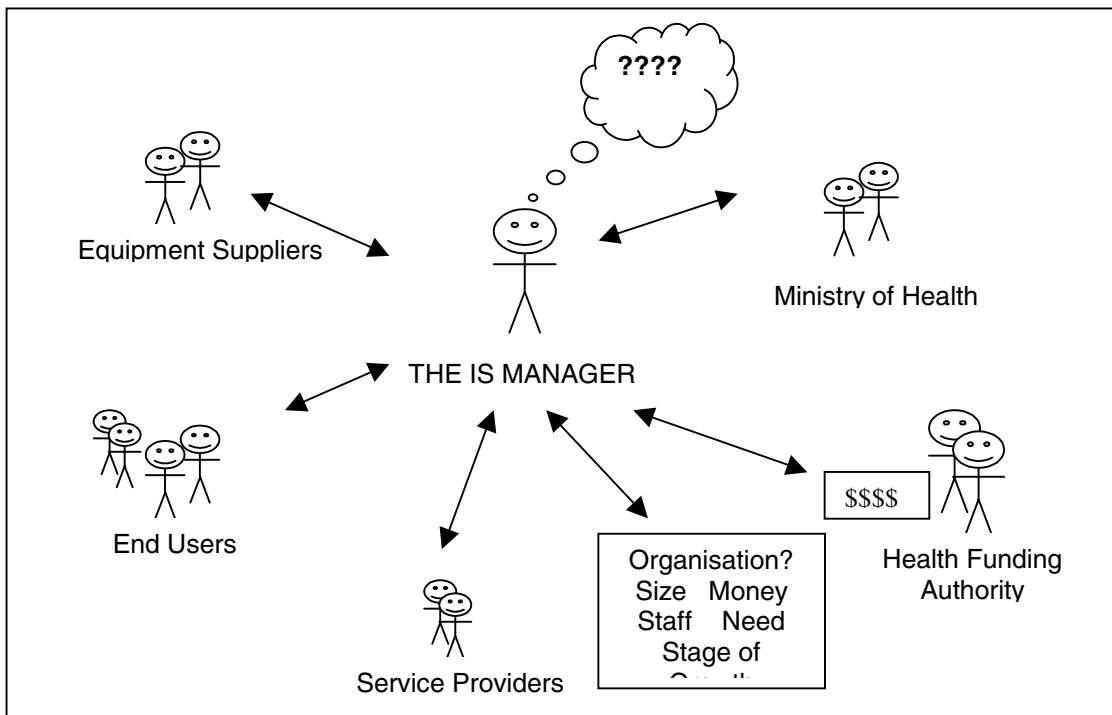
Figure 3 – IS Manager Rich Picture

Other issues which influence the IS manager include, the size of the organisation, the number of staff, the difficulty of the standard to implement, the level of computer usage, and the installed computers. This latter point is also extremely important in the context of healthcare in New Zealand, since there are three different types of organisations that are relevant here. Each of which will have their own characteristics in terms of equipment and expertise.

1. Public hospitals, which are generally large organisations with a large amount of patient throughput and a large amount of data.

2. IPAs which are much smaller than public hospitals, and a lot more physically disperse, and finally,

3. Private hospitals which are generally small and local healthcare agencies.
It should also be noted that although each of these organisations may have a role of an IS Manager, there will be considerable differences in the nature of the task and in the skills and expertise required of the person fulfilling that role.

In this way some of the tools of SSM helped us to gain an insight into context of the problem situation and to identify some of the major stakeholders and the roles that they played.

Surveying the Stakeholders
It was now appropriate to undertake some empirical investigation to solicit the views and opinions of the stakeholders regarding the priorities for the work on standards development. The traditional approach would be to develop and administer a

standardised questionnaire based on the SAF. However, this approach would be unlikely to be satisfactory because of the difficulty of designing a generalised questionnaire that would be appropriate for a sample population with such a diverse range of perspectives and levels of expertise.

These problems can be overcome by developing the questionnaire as a series of variants based around the central theme and addressing the same basic issues, i.e. those of the SAF. Each variant of the questionnaire can then be targeted to the context of a particular class of stakeholder and address the specific context in which they work. The questions and wording would therefore differ depending on whether the intended recipient worked for a Healthcare organisation of for an IT service provider.

Outcome and Results
This approach was used to develop a range of questionnaires that were administered to a range of stakeholders, a more detailed description of the process and outcomes can be found elsewhere (Weston, 1999, Weston and Whiddett 1999).

The findings confirmed the complexity of the subject area. Whilst all the factors identified in the SAF were seen to be important to all of the stakeholders, groups of stakeholders accorded significantly different priorities to different aspects of the SAF. For example, healthcare providers rated 'level of consensus' very highly but IT service providers ranked it as the least important aspect.

Differences in views were also found between the IS Managers of different types of healthcare organisations. These differing views can be interpreted in the light of the structure and maturity of the different types of organisations.

Furthermore, it was found that classes of stakeholders gave different priorities to different aspects of a standard depending on the application area (i.e. clinical coding, information exchange, technical infrastructure or IS management). For example, the IPA managers ranked *interoperability* as very important for standards relating to technology infrastructure but as relatively unimportant for standards for information management.

Summary and Conclusions
Healthcare and standards development are both complex areas to understand and to work in. Both have numerous stakeholders with contrasting perspectives. SSM techniques can be useful in giving a clearer understanding of the dynamics such situations, in particular it helped to gain an understanding of the development of standards for IT in healthcare.

The use of SSM techniques as a precursor to the development of a questionnaire tool helped to target the questions to the different perspectives and contexts of the stakeholders. In this way the two approaches can be seen as complementing each other in the attempt to resolve a problem situation that spans a large number of stakeholders.

References
Aiken, R. J., & Cavallini, J. S. (1994). Standards: When Is It Too Much of a Good

Thing? *StandardView,* 2(2), 110 – 119.

Aden, M., & Harris, M. (1993). A Practitioner's Guide to Standards and the Government. *StandardView,* 1(2), 25 – 34.

Baldo, J., Moore, J., & Rine, D. (1997). Software Reuse Standards. *StandardView,* 5(2)

Batik, A. L. (1989). *A Guide to Standards*. Philadelphia: Parker Colorado

Benjamin, B. (Ed.). (1977). *Medical Records*. London.

Cargill, C. F. (1998). Standardization: Art or Discipline. *IEEE Micro,* May/June 1998, 18 – 24.

Checkland, P. & Scholes, J. (1991). *Soft Systems Methodology in Action*. Wiley, Chichester.

Dick RS & Steen EB (1991) The Computer-Based Patient Record. IOM (Institute of Medicine) Report: National Academy Press, Washington, D.C.

Gritzalis, D. (1997). A baseline security policy for distributed healthcare information systems. *Computers & Security,* 16(8), 707 – 719.

Hovenga, E., Kidd, M., & Cesnik, B. (1996). Standards in health informatics, *Health Informatics: An Overview* (pp. 41 - 45). Melbourne: Churchill Livingston.

Morrell, J., & Stewart, S. (1996). Standards Development for Information Technology: Best Practice for the United States. *StandardView,* 4(1), 42 - 51.

NIST, National Institute of Standards and Technology. (~1998, 5 Jul 1995). Application Portability Profile. *http://www.nist.gov*.

National Health Strategy Unit (1993) Health that Works - Workplace Reform and Best Practice in the Australian Health Industry. In Thelander N (1994*) Transforming Health Care. Proceedings of the Second National Health Informatics Conference*, Gold Coast, Australia.

National Interim Provider Board (1992) *Providing Better Health Care for New Zelanders*. National Interim Provider Board, Wellington, New Zealand.

New Zealand Department of Health (1990) *Health in the 1990's*. Department of Health, Wellington, New Zealand.

New Zealand Minister of Health (1992) *Directions for Health and Independence*. Ministry of Health, Wellington, New Zealand.

New Zealand Minister of Health (1991) *Your Health and the Public Health*. Ministry of Health, Wellington, New Zealand.

Oksala, S., Rutkowski, A., Spring, M., & O'Donnell, J. (1996). The Structure of IT Standardization. *StandardView,* 4(1), 9 - 22.

Open_University. (Block IV). The Systems Movement, *Management and Change*.

Scott-Hill, B. (1996). Living standards - rethinking the standards development process. *Standards,* 42*,* 6.

UK Department of Health (1989) *Working for Patients*. HMSO, London.

Watson, R. & Smith, R. (1988). Application of the Lancaster Soft Systems Methodology in Australia. *Journal of Applied Systems Analysis*, 15, 3-26.

Weston, L. (1999) *The Use of Standards for Information Systems within New Zealand Healthcare* M.Sc. Thesis, Department of Information Systems, Massey University

Weston, L. & Whiddett, R. (1999) *The Use of Standards for Information Systems within Healthcare in New Zealand: Summary of Findings* Technical Report #2/99, Department of Information Systems, Massey University