

Cognitive Mapping as a Tool for Understanding the Development of Information Systems Planning: a Study of Two IT Managers

Neil McBride
Centre for IT Service Management Research,
De Montfort University

And

Ray Hackney
Department of Business Information Technology,
Manchester Metropolitan University

Introduction

The development of information systems strategy within an organisation requires the involvement of stakeholders who, through engagement with the information systems planning process, reach a consensus as what is required in terms of organisational information systems and how these requirements should be delivered. These stakeholders may emerge from top management, user management or IT management (Ruohonen, 1991). The level and nature of involvement of these stakeholders will vary. In one organisation a large strategic information systems planning group may be formed, in another the SISP exercises, perhaps using a methodology, will be driven by consultants reporting to a senior executive; in another, SISP may be driven by the IT manager. In each case a small group of people, or even one person, will be generating ideas and driving the process forward. Who the drivers of SISP are, and what influence they have may be affected by power (Horton, 1998) and personality (Reponen, 1996). What ideas are generated may be affected by the individual, organisational and external context in which the SISP process is taking place. The context, both social and technical will influence the cognitive maps of the strategists. Managers do not plan in a closed room, but learn from experience (Ruohonen, 1991). As the IS strategist take part in the continuous discourse which leads to the formation of a information systems plan (Walsham, 1993) concepts or themes emerge which may be reinforced by discourse within the strategy teams and with the recipients of the strategy, as well as inter- and extra -organisational influences.

Instead of seeing the process of SISP as a number of steps, in which we move from one to the next, SISP should be seen as the process of developing a cognitive map from which action in terms of information systems implementation is generated. These cognitive maps are built within the minds of individuals and developed within the organisation to become the agreed view of how things are, what is important and what should be done. However, these maps are not fixed, rather they are constantly changing as a result of

individual and organisational learning, experience from the actual implementation of SISP and organisational and political change. The cognitive maps should result in changed thinking as they develop dynamically as part of a dynamic SISP process (McBride, 1998).

The use of cognitive maps has been a feature of strategic management, strategy development and decision making over the past decade. Cognitive maps provide a simple and intuitive means of highlighting important strands of thought. In particular, they have been a core aspect of the Strategic Options Development and Analysis (SODA). (Eden, 1989; Eden et al, 1992, Ackermann and Eden, 1994; Eden and Spender, 1998). SODA involves the creation of individual cognitive maps and their synthesis into a group cognitive map which provides a network of ideas expressed in the language of the participants. The process generates rich models that lead to changed thinking and action rather than planning. Cognitive maps have been used in IT strategy development (Smith et al, 1995) and for business education in IT implementation (Fleck et al, 1996). However, they have not been widely used by information systems researchers and practitioners. If IT strategy is greatly influenced by the tacit knowledge, subjective beliefs and deeply-held assumptions of the stakeholders, a means of surfacing and exposing those assumptions would be helpful in determining IT strategy. The success or failure of IT strategy and implementation may be influenced by the cognition of key people, their mental models and belief systems and how they make sense of their organisational environment (Weick, 1995).

The work of Earl (1993) identified five approaches to SISP. The most successful approach was the organisational approach, in which themes are generated by senior management, for example, customer rather than product-focus in an insurance company, high service levels in a food company, product development performance in a chemical company. Themes are allocated to special task forces which tackle the business problem and develop associated IS strategies. The organisational approach recognises that SISP is not a special or neat-and-tidy endeavour, but is based on IS decisions being made through continuous integration between the IS function and the organisation (Earl, 1996). The success of the organisational approach (Earl, 1993, Doherty et al, 1999) may be in part due to the ease with which themes may be integrated into both individual and organisational cognitive maps. A major theme becomes a hook onto which other ideas can be attached. It becomes the centre of a web of related ideas that may form the basis for developing strategy. It becomes the standard to which troops rally, reinforced through social and organisational networks. Themes and their linked cognitive maps may naturally enable alignment since they provide a common language and focus.

If IS strategy evolves from the developing cognitive maps of the IS strategists and recipients, an understanding of those cognitive maps may help in understanding the developing process of IS strategy. Furthermore the analysis of cognitive maps of organisational members may provide an improved approach to IS strategy in which the identification and evaluation of themes and associated concepts is used to generate requirements for IS systems and services. Cognitive maps should not only be used to

identify the concepts that give rise to IT strategy, but also as a basis for considering what gave rise to those concepts and what their validity is.

This paper follows a case study of two IT managers at a UK hospital, between 1991 and 1996, a period of significant change in the UK health services (Gillies, 1998). Ideas from social cognitive theory are used to interpret the case study and shed light on the process of IS strategy building. Finally, the paper aims to provide a valuable classroom case study for IS teaching and to this end possible questions are provided at the end of the paper.

Case Study: Bethany General Hospital

This case study was developed from interviews with Jim and Mick, from documents and from consultancy carried out by N.McBride. Mick was also interviewed in his previous job as an IT manager in another hospital.

The Hospital

Bethany General Hospital is a small district hospital providing acute services and accident and emergency to a regional town and its surrounding areas.

1. Jim

When Jim arrived at Bethany in 1991 a resource management project run by the general manager and a clinical audit project were already underway. The resource management project was examining the procurement of a case mix system. A Resource management steering committee was working on this project, which also involved organisational development and culture change as part of the brief.

The clinical audit project had selected a clinical audit system which was to be procured using ring-fenced funds provided by Government. A clinical audit committee was overseeing the procurement and installation. A study by an external consultant had pointed out the overlap in information provision between clinical audit and resource management.

Jim recognised a need for strategy development. While having a culture that was more open to change than in other hospitals at which Jim had worked, he felt that IS strategy was lagging behind other hospitals.

The resource management initiative and the adoption of a new management model within the hospital provided the drive for the development of IS strategy, using the ideas of resource management as a focus. Jim developed closer links between the medical and management strategies through his involvement in clinical audit and the clinical audit manager's involvement in resource management. The co-location of the resource management and clinical audit teams in a portakabin helped avoid the pursuance of parallel IS strategies. Jim was able to suggest that the future of the clinical audit system was limited. The clinical audit committee accepted this:

‘ We won’t be purchasing any additional systems of that nature. [The clinical audit system] fulfilled a valuable role in starting the IT ball rolling, but that particular avenue of development has drawn to a close ’

Jim was proposing generic approaches to the provision of specialty information as part of the new IS strategy. He wished to avoid the fragmentation and duplication of systems by clinicians and managers and by different specialties.

Before Jim arrived a draft IS strategy had been developed as part of the process of devolving responsibility for IT from the region to hospital trusts. This had involved IT staff in talking to management, clinicians and support staff. Jim repeated the exercise, collecting views throughout the hospital over a period of a year. This involved examining operational processes and collecting the views of staff. Rather than a formal exercise in strategy development using strategy development meetings, Jim preferred to develop strategy from operational needs:

‘I have been involved in strategy development before where you go round and have strategy development meetings. There is a place for those, but there is only so much you can get out of that type of meeting. Far better to see strategic priorities emerge from processes that are happening around you. An example would be where business plans emerge at a directorate level and out of that a whole set of information needs arise.’

The thrust of the strategy development was on practical requirements. Access to validated corporate information tying together the managerial, financial and clinical interests was seen as being most important. The strategy was based on the hospital's business needs and problems and was seen as a statement of independence from the influence and control of region.

A key element of the strategy concerning the provision of corporate information for contracting. Between 1987, when the ‘Working for Patients’ resource management white paper was published and 1993, a change of emphasis away from audit to contracting had occurred. For Jim, contracting provided a clear focus for the IS strategy. Contracting provided a clear information requirement to be delivered within a certain timescale. Benefits and paybacks were now defined and tangible: information systems were required in order that the hospital would receive payment through contracting.

‘ [Contracting provides] clearly defined, focusable, tangible benefits in the short term, whereas some of the more esoteric elements of resource management were must longer term. People were looking for paybacks within the three-year timetable of resource management which was unrealistic. Delivering contracting within the three years is viable. ’

‘Esoteric elements’ of resource management concerned the involvement of people and giving them access to information to change the way they did things.

While the strategy had been developed, some procurements had been underway; some of which were already planned before Jim's arrival: there was a tension between long term strategic IS development and actually doing something quickly. Patient Administration System (PAS) upgrades were carried out and the system moved to a Unix platform by November 1992. A laboratory management system was installed by November 1993 and was followed by a hospital-wide LAN. A case mix system had been procured with the help of Region.

However, while retaining involvement in regional case mix procurement, Jim pulled out of a regional Nursing system procurement because of doubts about how it fitted in with the resource management strategy. An examination of ward information requirements as part of a broader communications strategy suggested that nursing requirements could be fulfilled by other means involving information in PAS and Case Mix. Nursing systems would not be procured by would be incorporated into overall patient care systems.

At the end of 1993, a national information management and technology (I M & T) strategy was being developed. Jim saw this as a major problem and inhibitor of information strategy progress at Bethany.

2. Mick

When Mick took over as IT manager, the first task he undertook was a review of the state of information systems in the hospital, particularly in the context of the internal market. He conducted workshops to examine the current state of investment and to identify current problems. He wanted to base his strategy on the top 20-30 problems, giving 5 problems the highest priority. He talked to the IT personnel and end users about what they were getting out of the existing information systems. However, he discarded the previous IT strategy:

'I kept it at arms length as it was written three years ago and the ground has moved tremendously since then. I think it was fair to say that it was outdated.'

In late 1996, the draft strategy which identified the top problems was going through a process of approval. Mick found the main problems to be out-of-date telephone directories, a lack of electronic results at the ward level, problems with patients notes, lack of control of test and drug requests, pathology and radiology and bed-state management. The telephone directory problem was rapidly sorted out through the provision of an electronic telephone directory.

Mick felt that the focus of hospital information systems had moved away from clinical support because of the demands of the internal market. By the time he came into post the clinical audit system had been abandoned:

'I understand the system didn't meet user requirements . What I didn't see in my document analysis was any user requirement specifications for a clinical information system. '

The case mix system which had clinical functions was not being used for clinical support. Although the clinicians had been heavily involved in its selection, they were getting little benefit out of it. Case Mix was being used as the core management information system, Analysis and pricing were derived from case mix information. The report to the boards and all operational reports were extracted from it as well as any information needed to support business planning processes.

In order to encourage clinical involvement with case mix, additional software was purchased which would enable clinicians to build profiles of cases using the case mix system. There was a commitment to the case mix system that made it a focus of the information systems strategy:

'We can't abandon case mix because it is our core MIS. Our board report comes off it, all our operational reports, any information we need to support business planning process, so it's key to the hospital.'

However, case mix had its own problems. While it was fine for operational needs, it was not suitable for real-time operational needs, such as the rapidly delivery of test results to the ward. In addition, the inadequacies of the user interface were seen as an inhibitor to its clinical use. Mick championed the use of a software tool, Business Objects, which provided a user-friendly front-end for analysing case mix data, and trained staff in its use. Furthermore, a contract management module had been purchased for use with case mix that replaced an existing contract management system. The aim was to have a completely integrated management system, with the whole information department using Business Objects to extract data. Costing was another problem to which the answer would be obtained from case mix. However:

'[Case mix] is not going to be hi-jacked by a costing mechanism. I think it's important that our strategy is now clinically focused.'

The patient information system, which in 1996 was ten years old, while performing well, was due for replacement. The supplier, having obtained intellectual property rights on a replacement system, decided to pull out of the healthcare market. This made the need to replace PAS all the more urgent. The absence of good systems at ward level, the lack of basic support in patient administration, the ability to order tests from the wards and the ability to record results, were seen as issues to be associated with PAS and its replacement. Similarly, Mick considered that the inadequacies of the discharge process, including illegible discharge summary letters, needed to be addressed at the ward level. A nursing management information system which gave nurses the ability to produce their own care patterns and do their own rostering was not planned because it did not fit in with the perceived strategy:

'I see [our] strategy as being [the development of] a multi-professional system .. in which the whole philosophy is that professionals work together on single patient records.'

Mick realised the importance of identifying the benefits of information systems within the hospital and making sure benefits were delivered. Mick established a benefits realisation team, with members from each directorate. This team identified problems that might be relieved through information systems solutions:

'This is similar to what we've done on the strategy workshops. We have then looked at which problems could be resolved by implementing IS solutions and then we've looked at a series of options. We have looked at the one that may yield the greatest benefits... So what [the benefits realisation team] is doing now is going back ...and saying, 'well, if we implement this [particular] solution, how much time will it save?' They are then converting that into a cash saving or looking at changes in the process we could make if we invested in IS which might [also] yield cash. When we finish this exercise we will be in a position to estimate what the cash benefits are.'

Benefits were to be built into systems procurement contracts. Suppliers would get paid when benefits were delivered. A government initiative had provided a quarter of a million pounds for a Case Mix Management System, without really considering what the system was for or what the benefits would be. Mick found it difficult to get clinicians to say what the benefits they would expect from the system.

Little use had been made of centrally-generated information systems strategies.

'Like all long-term strategies the immediate operational benefits are very few.'

Systems had been modified in preparation for new NHS numbers. Also, Mick expected that there would be benefits from the NHS Net. Mick was intending to start work on a GP links project, but was not sure whether to use a local X25 network or the NHSNet. Centrally generated information systems strategy was seen as remote and of limited relevance to the day-to-day operational problems that local strategy addressed.

Mick's remit in Information Management and Technology was broad. It involved managing telecommunications, library services, medical records as well as computer services. This was reflected in the strategy that he felt differed from a pure IT strategy. Importantly his strategic job involved managing change and benefits:

'I think the Director of IM and T these days needs to be a hybrid person. It's not just about having knowledge about IT services.'

Analysis

Cognitive maps are developed by the researcher following an interview with the stakeholder. Key concepts are identified and described in short phrases. In some cases a concept may be clearer when its opposites is recorded, the two being connected by three dots. Relationships between concepts are indicated by arrows. Arrows can also be used to indicate dependency, negatively signed if the effect is deleterious. The following

analyses cognitive maps derived from interviews with Jim and Mick and examines the issues raise that relate to the development of IT strategy.

Jim

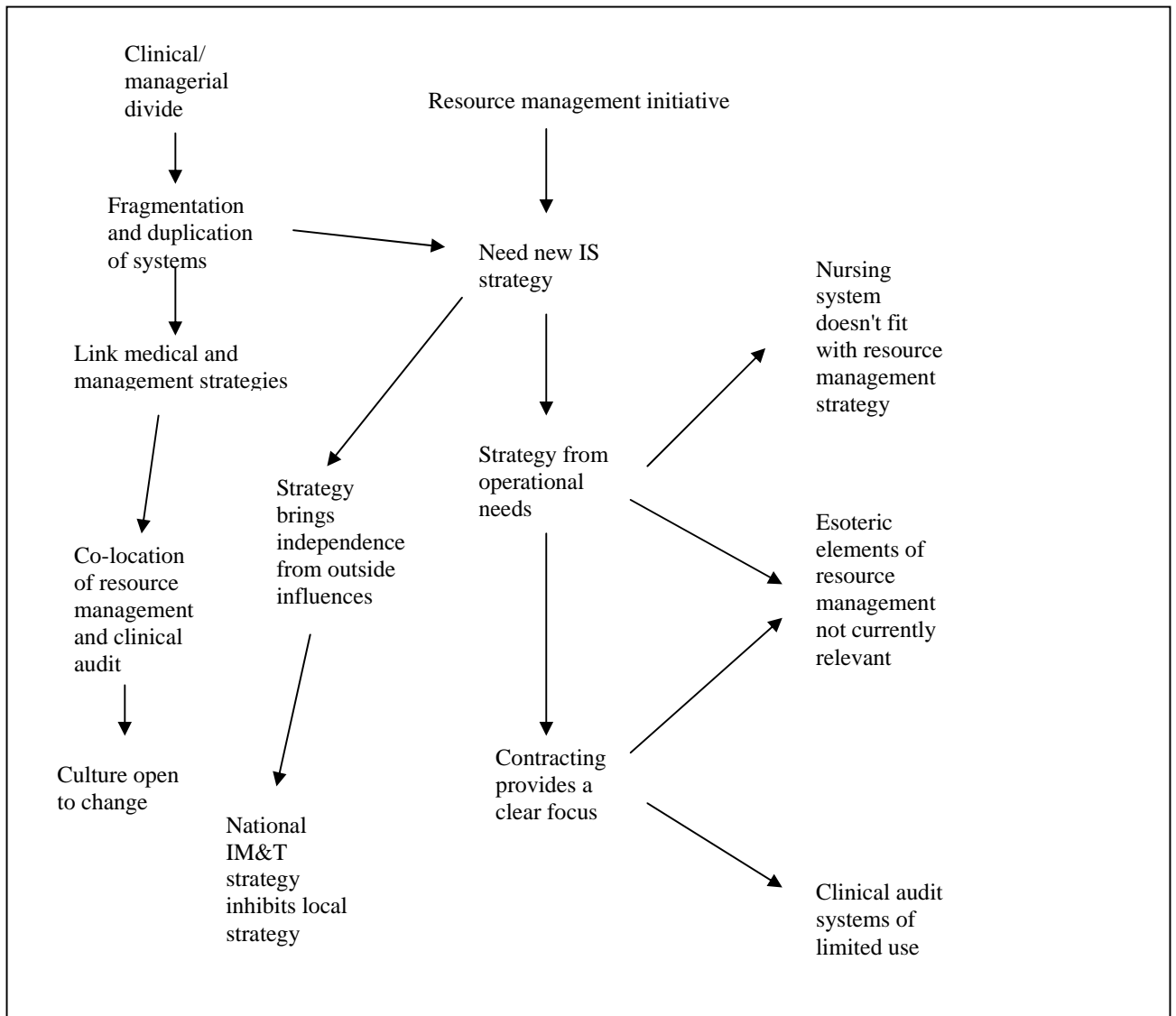


Figure 1: Jim's Cognitive Map

Cognitive maps reveal concepts and thinking behind both the process and content of IS strategy. For Jim, the process of strategy revolves around practical requirements. The

process involves identifying clear information needs and planning their delivery, rather than pursuing high level meetings and considering IS strategy in the abstract. Strategy is an emergent process, priorities resulting from currently active processes. Behind that process lies a political goal of freeing the hospital IT from the control of region and reducing outside influence. In terms of content, National IM&T strategy is not only dismissed, but also seen as a threat to the development of hospital IS strategy. However, national resource management strategy is a key influence on Jim's thinking. The relevance of various information systems is judged against it. Nursing systems are rejected and case mix promoted to a central position in the light of its relevance to resource management. Even so, the resource management initiative is only welcomed in as far as it fits with Jim's view that strategy should be operationally focussed, delivering tangible benefits in short timescales. Where resource management ideas become more long term, they are labeled 'esoteric'. The divide between clinical and managerial in the hospital is an important concept to Jim. The presence of disparate information systems, involving duplication and fragmentation of information is seen as evidence of this divide. In this light, the co-location of clinical and management information functions has special meaning and encourages Jim to believe that the culture is open to change. Furthermore, the presence of the clinical audit system is seen as contributing to that divide and something to be drawn to a close. Equally, case mix is seen as having the potential to act as a unifier.

An understanding of the cognitive map which Jim has for IT strategy formulation makes it clear where Jim is coming from: IT strategy must be operationally based, produce quick visible benefits and unite clinical and medical interests. This forms Jim's vision and results in the prioritisation of some IT systems over others. In addition, it is important to consider how Jim's views formed and whether they were valid. Jim's concepts may be influenced by both national and hospital political strategy, which focussed on contracting and his previous experience of strategy development meetings. Cognitive maps in strategy practice provide a starting point for collectively exploring the issues and coming to a consensus. Some ideas may have to be rejected. A focus on contracting may have produced short-term benefits. Since 1997, the importance of contracting has significantly reduced. A focus on patient information and the delivery of accurate and timely patient data could have provided a long term focus with some short term benefits.

Mick

The construction of a cognitive map for Mick (Figure 2) highlights some of the strategic vision that he carried in his mind. Certain concepts are present which drive both strategy and implementation. For Mick, a key theme is that of a need for an integrated management information system in which everyone in the hospital accesses data from a single pool. At the heart of this pool of data will be the single electronic patient record (EPR). A further theme is that of clinical support. In reacting to a historical focus on information for hospital managers, particularly concerning costing, Mick has picked up a concept which was previously part of the resource management initiative. The delivery vehicle for clinician involvement is case mix.

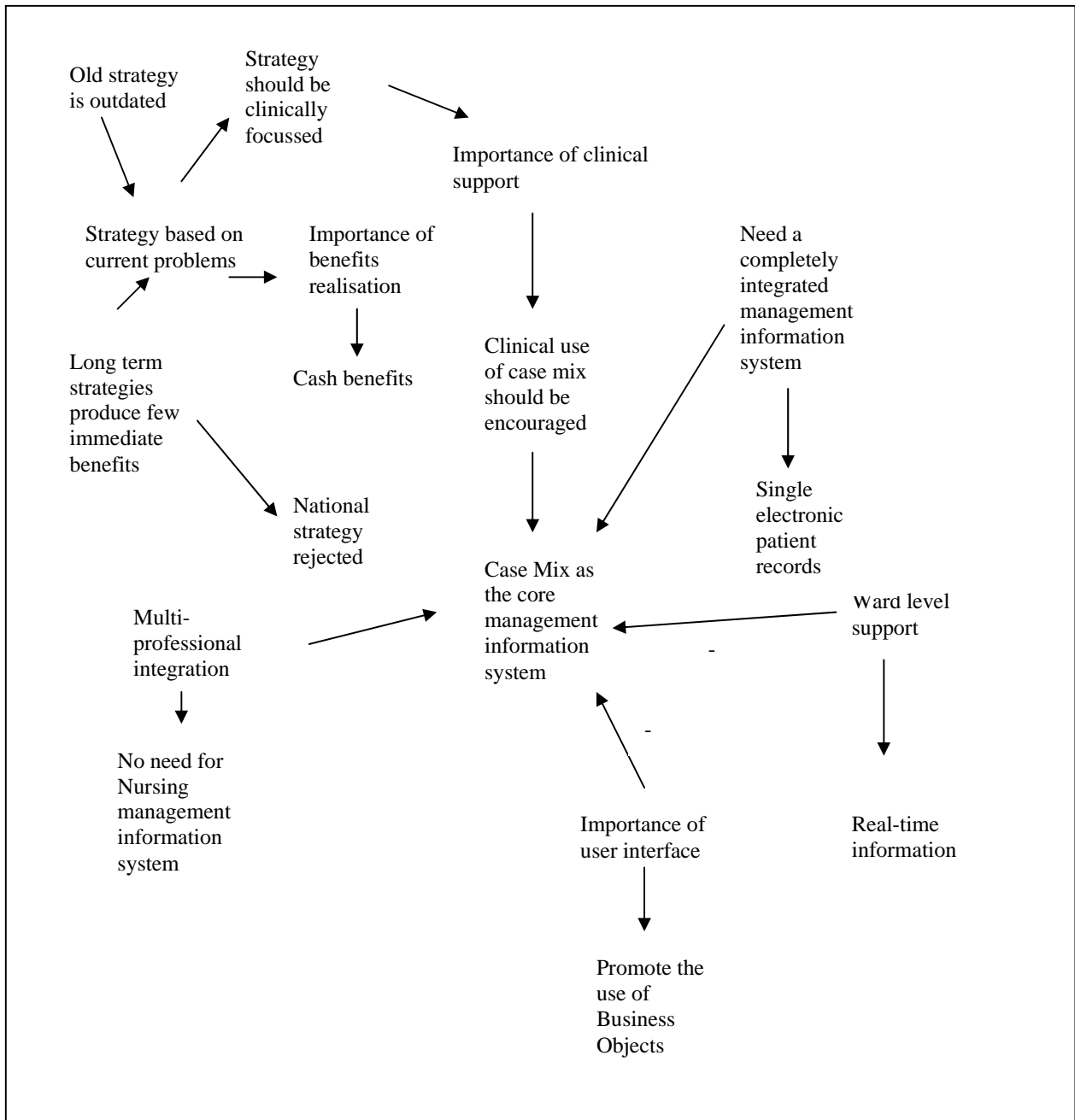


Figure 2: Mick's Cognitive Map

The importance of case mix is a fixed point in Mick's cognitive map. Case mix provides an implementation focus for themes including MIS integration and clinical support.

Where other cognitive elements might threaten case mix, solutions are found to support the primacy of it. Thus the inadequate user interface is overcome by the use of Business Objects. Extra modules are bought to support costing without its dominating the use of case mix, and to encourage the clinical use of case mix. Like Jim, Mick views strategy as deriving from operational requirements. There is a focus on practical benefits and cost savings resulting from this focus on operational strategy. Benefits realisation became such an important concept, that consultants were employed to advise on its implementation.

Several of Mick's concepts derive from experience as an IT manager at another hospital. An interview with Mick at his previous hospital identified concepts including: the importance of Business Objects as an interface tool, the potential value of case mix, the consolidation of systems into one environment and the importance of ward-based order communication. However, a main theme at the previous hospital, that of business process re-engineering (BPR), was not mentioned by Mick at the new hospital. Some anecdotal evidence suggests that the BPR exercise at the previous hospital had not been a success.

Comparing Jim's and Mick's cognitive maps of the same area of knowledge - IT strategy for Bethany hospital - identifies some interesting similarities and differences. Both see IT strategy as arising from operational requirements. Both highlight the importance of case mix, although this is more important for Mick than for Jim. Both reject the clinical audit system, although for different reasons. The clinical audit system is more salient for Jim because it represents a barrier to clinical/ managerial integration. For Mick, it is more a matter of historical interest. Both reject nursing information management systems, although Jim's reason is more technically based than Mick's. Mick rejects it because of lack of managerial fit. Both reject national IM & T strategy. The cognitive maps suggest that IT strategy at the hospital is not being driven by any formal-rational framework, but rather by the experiences, assumptions and prejudices of the IT strategists.

Developing a cognitive map brings into stark relief the ideas that are driving Jim and Mick's development of strategy and implementation of IT at the hospital. From a researcher's point of view, the derivation of IT strategy can be explained. From a practitioner's point of view, key themes can be questioned. There is an opportunity through discussion to alter cognitive maps.

Conclusions

People maintain expectation of the world to which they fit their experience. These everyday theories about cause and effect influence their strategy for dealing with problems (Gopnik et al, 1999). Unless surprised by the unexpected, these theories form the basis for strategy formulation in information systems. The experiences which give rise to IT strategy may be derived from attempts at IT implementation, previous IT strategy formulation, or simply what the strategist has seen or been told. Ideas may be literally copied from other organisations. If children, when shown a film of a woman punching a clown doll, then imitated her in a nursery class (see Boeree,C, 1998), there is no reason why IT managers in hospitals should not imitate each other, thus reinforcing ideas and strategic directions.

In order to understand the development of IT strategies within organisations, we must understand the thinking of the managers, IT strategists and users who develop and implement the strategy. Cognitive mapping provides a tool to do this. However the subjective thinking of managers does not develop in isolation. Ideas can spread and take hold through networks of communication. Theories such as Structuration Theory (Walsham, 1993) and Actor-Network Theory (see Walsham, 1997) explain how ideas about technology spread and are accepted. There is a continual exchange between the individual and the organisation. Organisational thinking is influenced by individual thinking, mediated by power and norms of behaviour. In turn, organisational thinking influences and changes individual thinking. From this flow of ideas organisational strategy and direction emerges and evolves.

Acknowledgment

We thank Margaret Radford for help with transcribing interviews.

References

- Ackermann,F and Belton,V (1994) Managing Corporate Knowledge Experiences with SODA and VISA. *British Journal of Management* 5, 163 - 176.
- Boeree,G (1998) Personality Theories, Albert Bandura.
<http://www.ship.edu/~cgboeree/bandura.html>. Accessed 23/10/00
- Doherty,N.F., Marples,C.G. and Suhaimi,A. (1999) The relative success of alternative approaches to strategic information systems planning: an empirical analysis. *Journal of Strategic Information Systems* 8, 263-283.
- Earl, M.J (1993) Experiences in Strategic Information Systems Planning. *MIS Quarterly* March 1993, p 1 - 23.
- Earl,M.J. (1996) An Organisational Approach to IS Strategy-Making In *Information Management: The Organisational Dimension*. Ed. Earl,M.J, Oxford, pp. 136 - 170.
- Eden,C (1988) Cognitive Mapping. *European Journal of Operational Research* 36, 1-13
- Eden,C., Ackermann,F and Cropper, S. (1992) The Analysis of Cause Maps. *Journal of Management Studies* 29, 309-324.
- Eden,C and Spender,J.C. (1998) *Managerial and Organizational Cognition* 1998 Sage, London
- Fleck, J; Scarbrough,H . and Swan, J. (1996) Oakland Case Study.
<http://omni.bus.ed.ac.uk/opsman/oakland/contents.htm> Accessed 20/10/00

Gillies, A. (1998) Computers and the NHS: An analysis of their contribution to the past, present and future delivery of the National Health Service Journal of Information Technology 13, 219 - 229.

Gopnik,A; Glymour,C and Sobel, D. (1999) Causal maps and Bayes nets: A cognitive and computational account of theory formation. International Congress on Logic, Methodology and Philosophy of Science, Cracow, Poland, August 1999, http://www-psych.stanford.edu/~jbt/224/Gopnik_1.html. Accessed 23/10/00.

Horton, K. (1998) Dynamics of Power in Information Systems Strategy. Proceedings of the 3rd UKAIS Conference, Lincoln University, p 118 - 126..

McBride,N. (1998) Towards a Dynamic Theory of Strategic IS Planning. Proceedings of the 3rd UKAIS Conference, Lincoln University, p218 - 230

Reponen,T, Parnisto,J and Viitanen, J. (1996) Personality's impact on information management strategy formulation. European Journal of Information Systems 5, 161 - 171

Rouhonen,M (1991) Stakeholders of strategic information systems planning: theoretical concepts and empirical examples. Journal of Strategic Information Systems 1, 15 - 28.

Smith N., Ackermann F. and Eden C (1995) Cognitive Mapping - A 'Hot Button' Approach to IT Strategy Development. Management Science Working Paper 95/15, University of Strathclyde.

Walsham, G (1993) Interpreting Information Systems in Organisations. John Wiley, Chichester

Walsham, G. (1997) Actor-Network Theory and IS Research: Current status and future prospects. In Lee,A; Liebenau,J and DeGross,J (Eds) *Information systems and qualitative research* Chapman and Hall, London.

Weick,K. (1995) Sensemaking in Organisations. Sage.

Appendix: Tutorial Questions

Jim

1. Explain Jim's attitude to resource management.
2. Why does Jim reject clinical audit systems and nursing systems?
3. Why might it be a good approach to develop strategy from operational needs? What are the disadvantages of this approach?
4. Why might a strategist find it easier to focus on contracting than to tackle IT strategy holistically?
5. What do you think Jim means by 'esoteric elements of resource management'?

7. Several public sector organisations including the NHS and the Probation Service are subject to directed, centrally generated IS strategy. What are the advantages and disadvantages if such an approach?
8. Explain the tension between long-term strategic IS development and actually doing something quickly.
9. Why might Jim see the hospital's IT strategy as a 'statement of independence'?

Mick

1. Describe the shortcomings of basing strategy on the top five information problems.
2. Why might the focus of hospital information systems have moved away from clinical support? Why is a focus on clinical support important?
3. Compare and contrast Mick's attitude to the clinical support system and to the case mix system.
4. Explain the advantages of an integrated management information system and a single electronic patient record.
5. In what ways does Mick's rejection of national IM & T strategy differ from Jim's?
6. Critically analyse Mick's concept of benefits realisation.
7. Contrast Mick's rejection of nursing information systems with Jim's.
8. Mick talks about 'strategy workshops', Jim talks about 'strategy development meetings'. Are these the same thing?