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The challenges of strategic data planning in practice: an interpretive case study

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Abstract

Many organisations have had difficulty with strategic data planning despite strong arguments about its value. A number of empirical studies of strategic data planning have identified various factors important to its success but few have presented detailed contextual explanations. This paper reports an in-depth, interpretive case study which examines the strategic data planning process in a large Australian bank. The paper explains why strategic data planning is such a difficult undertaking and suggests three important implications for practitioners. First, both business managers and information systems staff find the output data architecture difficult to understand, and improved representations and explanations of the data architecture should be used. Second, strategic data planning is a complex social activity and an understanding of the organisational context within which it takes place is critical to its success. Third, strategic data planning may not be the best way to build a data architecture, and other approaches which facilitate participation should be considered. © 1997 Elsevier Science B.V.

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1. Introduction

Poorly managed data presents real problems for the management of large organisations. Information from several functional areas within an organisation is frequently required for strategic decisions. For example,

a major bank seeking to shift its strategy toward a focus on customers finds that it cannot determine how profitable individual customers are, or even what its total

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business is with each customer, because its customer codes are not common across branches or lines of business (Goodhue et al., 1988, p. 373).

This inability to respond to cross-functional questions reduces an organisation's potential to respond to business problems and take advantage of opportunities (Gartner Group, 1993). The goal of data management is to manage data as a corporate resource in much the same way as more tangible assets such as equipment and personnel are managed (Trauth, 1989). Without data management different parts of an organisation will collect and store their own copies of data, most likely in different formats. This leads to duplicated and inconsistent data and difficulty in the consolidation of data for reporting. Strategic data planning is a significant component of data management and aims to align the data management function with the business plans of an organisation and develop a data architecture.

There are strong arguments in favour of strategic data planning and data management (Martin and Finkelstein, 1981; Martin, 1982; Sager, 1988). Empirical studies, however, have highlighted many problems with the use of strategic data planning in practice (Beynon-Davies, 1994; Goodhue et al., 1988, 1992; Hoffer et al., 1989; Lederer and Sethi, 1988, 1991; Periasamy, 1994). Apart from Beynon-Davies (1994), who discusses the social and political context of strategic data planning in the British National Health Service, most of these studies develop contingency models or identify factors necessary for success in strategic data planning.

This study extends these previous studies. It uses a process-oriented, interpretive case study approach which focuses on the relationships between the actions of stakeholders in the strategic data planning process and the organisational context in which it takes place. The case study analysis explains why strategic data planning is such a difficult undertaking and suggests why alternative approaches to developing and documenting a data architecture should be considered. Results of this study will assist practitioners when considering the use of strategic data planning and indicate areas for further research.

Surveys of management information systems issues consistently rate developing an information architecture and making effective use of data as a corporate resource very highly. These were the two most important issues in the United States survey by Niederman et al. (1991), they were ranked four and six in the Australian survey by Pervan (1993) and they were ranked two and four in the European survey by Galliers et al. (1994). Clearly strategic data planning is an important issue for both academics and practitioners.

The paper is structured as follows. The next section of the paper discusses strategic data planning. Section 3 describes the research approach adopted in the study. Section 4 describes the case study using a process-oriented framework and analyses the case study using structuration theory. The following section relates the case study findings to previous studies of strategic data planning and the paper concludes with some suggestions for further research.

2. Strategic data planning

Strategic data planning is a top-down, data-centred approach to information systems planning which focuses on modelling the underlying shared data within an organisation

(Goodhue et al., 1992). It is categorised as ‘technological’ in Earl’s (Earl, 1993) taxonomy of strategic information systems planning approaches. The principal output of strategic data planning is a data architecture which is described as ‘a high level map of the information requirements of an organisation’ (Brancheau and Wetherbe, 1986). Strategic data planning is justified in that it will help improve poor, inconsistent data quality, assist with the integration of information, and gain control of data redundancy (Martin, 1982). The organisational unit responsible for building and using the data architecture is the data administration group (Kahn, 1983).

Many organisations have had difficulty using strategic data planning despite strong arguments about its value. A number of case studies in the literature have highlighted the following problems:

- The data architecture is difficult to understand and communicate (Earl, 1993; Goodhue et al., 1992; Kim and Everest, 1994).
- Sustaining management support for the data architecture is difficult (Goodhue et al., 1988, 1992; Hoffer et al., 1989; Kim and Everest, 1994; Lederer and Sethi, 1988, 1991).
- The data architecture is organisationally difficult to implement (Allen and Boynton, 1991; Beynon-Davies, 1994; Brancheau et al., 1989; Goodhue et al., 1988; Lederer and Sethi, 1988, 1991; Loring and DeGoris, 1991).
- Strategic data planning may not be the best way to produce a data architecture (Beynon-Davies, 1994; Goodhue et al., 1988, 1992; Hoffer et al., 1989).
- A balance between long-term and short-term benefits must be achieved (Goodhue et al., 1988; Kim and Everest, 1994).

Goodhue et al. (1992) (p. 28) conclude their case studies by suggesting that ‘a great deal more attention should be given to understanding specifically how data architectures can be used in large organisations’. This study focuses on the process of strategic data planning within a large Australian bank, and develops a detailed description and analysis of how a data architecture was built and used over a number of years. Results of the case study are related to the problems listed above and a number of implications for practitioners are identified.

3. Research approach

A process-oriented case study approach has been adopted to enable the relationships between organisational change and the actions of those involved in strategic data planning to be explored. This approach focuses on the process by which the data architecture is built and used rather than on establishing causal relationships between variables (Markus and Robey, 1988). A case study approach allows the investigation of strategic data planning in its natural setting (Yin, 1994). The theoretical framework used to describe the case is based on Orlikowski’s (Orlikowski, 1993) framework for understanding the process of adopting CASE tools within organisations. Concepts from structuration theory are used in the case study analysis (Giddens, 1976; Walsham and Han, 1991).

The study focused on an Australian bank. Banks are critically dependent on their

information systems and the bank selected for the case study had extensive experience with strategic data planning. Broadbent and Weill (1993) note that the financial services area is relatively mature in its information strategy development processes. The unit of analysis for the case study was the data administration group and its interaction with information systems project teams.

Data for the case study was collected from a number of sources at the bank. These include unstructured and semi-structured interviews, questionnaires, data architecture documentation, planning documents for the data architecture and annual reports (from 1990 until 1994). The use of multiple data sources allowed for cross-checking of the data and permitted multiple perspectives on important issues. Four individuals participated in the study. These were the manager of information systems strategy, the manager of the data administration group, a consultant with the data administration group and a project manager who was a user of the data architecture. Initial semi-structured interviews took place in 1993 and several further unstructured interviews took place between 1993 and 1995.

3.1. A framework for understanding the process of strategic data planning

A number of different frameworks have been used in processual studies of information technology and organisational change. These include diffusion of innovation models (Fichman and Kemerer, 1993; Rogers, 1983), stages of growth models (Galliers and Sutherland, 1991; Nolan, 1979), organisational culture and punctuated equilibrium models (Ciborra and Lanzara, 1994; Gash and Orlikowski, 1991; Lewin, 1952; Schein, 1992) and models based on the interactions of the actions of individuals with the organisational context (DeSanctis and Poole, 1994; Orlikowski and Robey, 1991; Orlikowski, 1993). As this study focused on the interactions of systems development professionals in strategic data planning within the social and organisational context of the organisation, Orlikowski's (1993) framework was selected as the most appropriate for the case study description.

Orlikowski's (1993) framework for understanding the process of adopting and using CASE tools was used in the case study description. This framework was developed using a grounded theory approach and focuses on the relationships between the actions of stakeholders in the process of introducing CASE tools and the organisational context in which it takes place. As with the introduction of CASE tools, strategic data planning represents a 'reorientation in systems development' (Orlikowski, 1993, p. 337). The framework proved particularly useful for representing the strategic data planning process and was helpful in communicating with case study participants.

The framework represents the interaction of strategic conduct and institutional context over time (see Fig. 1). Strategic conduct consists of three broad, sequential activities which describe the longitudinal process of adopting and using strategic data planning. The *conditions for adopting and using strategic data planning* describes the recognition and articulation of information systems problems and the subsequent formulation of intentions about the changes expected to occur. The *adoption and use of strategic data planning* is concerned with the use of strategic data planning to produce a data architecture and the accompanying changes to information systems policies and procedures and information

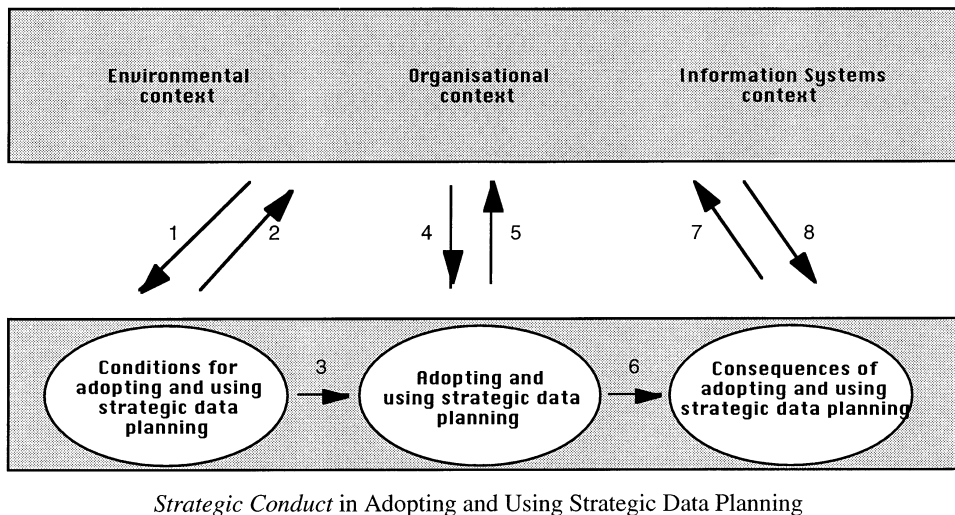
Institutional Context for Adopting and Using Strategic Data Planning

Fig. 1. A framework for understanding strategic data planning (adapted from Orlikowski, 1993).

systems structure and operations. The *consequences of adopting and using strategic data planning* describes the reactions of the key players (in this case the manager of information systems strategy, the data administration group manager, the data administration group consultant and the project team leader) to the strategic data planning exercise.

Institutional context is structured into environmental, organisational and information systems contexts. *Environmental context* is external to the organisation and concerns business conditions and industry-wide trends in information systems. *Organisational context* concerns the structure and culture of the organisation and the role information systems plays in the organisation. *Information systems context* concerns the structure and operations of the information systems department and its policies and practices.

The interaction between the institutional context and strategic conduct represents how the context can influence and constrain the actions of stakeholders and how the actions of stakeholders can also reinforce and change the institutional context. The framework should be understood as a dynamic model in which there is continuous change within the institutional context, and actions within the strategic conduct are constantly being revised.

3.2. Structuration theory

Structuration theory is concerned with how and in what ways the actions of individuals are related to the structural features of the societies of which they are part (Thompson, 1989). It attempts to resolve the fundamental division within the social sciences of theories which view social reality as the product of subjective interpretations of the actions of human 'agents' and theories which emphasise the objective and institutional nature of the

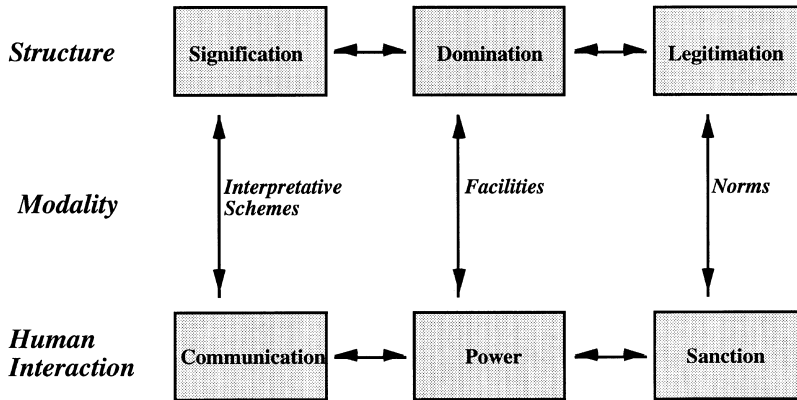


Fig. 2. Analytical dimensions in structuration theory.

social structures which influence human action. Agency and structure are seen to be independent and conflicting elements (Jones and Nandhakumar, 1993).

Giddens resolves the agency/structure debate by proposing that they should be understood as a mutually-interacting 'duality' in which 'social structures are both constituted by human agency, and yet at the same time they are the very medium of this constitution' (Giddens, 1976, p. 121). Social structure is an abstract property of social systems, and does not exist independently of the human actors who enact and interpret it. Structure is seen as rules and resources existing as memory traces in the mind, which are drawn upon in human action and interaction (Walsham and Han, 1991). Agency refers to the volitional nature of the actions of humans as knowledgeable 'agents'. Structure and agency are understood to have a continuous and irreducible interaction whereby social structures are produced and reproduced by action and in turn inform and constrain that action. Structuration implies a shift from a static to a dynamic description of the interaction between action and structure; that is, from structure to structuration (Giddens, 1976).

Giddens (1976) identifies three dimensions of structure: signification, domination and legitimation. These are seen as interacting with three dimensions of human interaction: communication, power and sanctions. Giddens specifies the three modalities of *interpretative schemes*, *facilities* and *norms* which link the realms of structure and interaction. This is shown in Fig. 1. The separation of these dimensions is purely an analytical device, since in practice they are inextricably interlinked. For example, the effective operation of sanctions depends upon power relationships and is deployed through language (Jones and Nandhakumar, 1993).

The three modalities mediate the linkage between social structure and human interaction. *Interpretative schemes* are shared stocks of knowledge which humans draw upon to interpret actions and behaviour, thus achieving meaningful interaction and communication. In this way structures of signification (meaning) are produced and reproduced (reinforced). *Facilities* are the means through which intentions are realised, goals are accomplished and power is exercised. It includes the ability to mobilise and allocate material and human resources. The use of resources produces and reproduces structures

of domination. *Norms* are rules and conventions of appropriate conduct which define legitimate interaction within the moral order of a setting. Human actions are sanctioned by drawing on norms of behaviour and morality. Thus, structures of legitimation are produced and reproduced.

These concepts can be illustrated by applying them to the activity of using systems development methodologies within organisations. A systems development methodology is usually described as a number of phases, tasks, techniques and deliverables, and is open to interpretation by stakeholders in the systems development process (Avison and Fitzgerald, 1995). When using a systems development methodology, our interpretative schemes allow us to understand the concepts in the methodology and thus communicate about the methodology to other development stakeholders. Our interpretation of the methodology is therefore a structure of signification as it represents shared knowledge about the process of systems development. The systems development methodology may also be seen as a mechanism by which a centralised information technology group within an organisation can maintain authority over project teams. Monitoring of adherence to the methodology by the information technology group would be an attempt to centralise power over systems development. In this way use of the systems development methodology may be seen as a facility through which power is exercised, producing and reproducing the structures of domination in the organisation. A legitimate form of behaviour in the organisation may be to adhere rigidly to the systems development methodology during systems development. This behaviour is sanctioned when it is seen as the norm, and the structure of legitimation is therefore reproduced by the use of the methodology.

Although interacting in established ways reproduces and reinforces existing structures, humans are knowledgeable agents who monitor their situation reflexively. Identified with humans' ability to monitor their domain of action are two forms of consciousness: *practical* and *discursive*. Practical consciousness refers to the ability of people to act in a knowledgeable way, and discursive consciousness refers to their ability to provide explanations and rationalisations for these actions, and permits reflection on them. Giddens argues that we know more than we can say. Being knowledgeable agents capable of independent action, humans may choose not to follow established norms of behaviour and thus to transform social practices. For example, disputing the meaning of the concepts in a systems development methodology or avoiding its use would not reproduce the existing structure, and if a sufficient number of people behaved in this way new structures would emerge. However, being aware of structural constraints and of the potential for change does not guarantee that the capability for independent action which changes social structures will be exercised. Structuration acknowledges the concept of the *routinisation* of social activity which reinforces people's sense of security and explains why established social structures are continually reproduced (Walsham and Han, 1991). Routinisation contributes to the stability of organisations and helps to explain the difficulties of change management. Attempts to change routine work practices within an organisation will potentially impact routinisation. For example, if project teams do not normally follow a standard systems development methodology, then the introduction of one will disrupt their established routine and may lead to conflict and resistance.

Human agents are typically unaware of the way in which structure is produced, and unintentionally reproduce social structures (Orlikowski and Robey, 1991). This, combined

with the possibility of transformative action, leads to the inevitability of *unanticipated consequences of intentional action* (Lyytinen and Ngwenyama, 1992). Thus all action carries with it the potential for change. For example, in terms of systems development, an overly optimistic statement of expected outcomes in order to gain management support may in fact result in greatly diminished support if the outcomes are not achieved within a reasonable time frame.

One further concept from structuration theory is *structural contradiction*, which refers to a 'disjunction between different principles of system organisation' (Walsham and Han, 1991, p. 83). When interaction occurs between human agents acting within differently organised social systems then the potential for structural contradiction exists. This can lead to conflict between agents within an organisation, and to resistance to the process of organisational change. For example, the introduction of a standard systems development methodology with its centralising tendencies into a highly-decentralised organisation with autonomous business units may create a disjunction between these types of organisational structure. Interaction between the central information technology group and the business units will be strained as each group tries to maintain its structures of signification, domination and legitimation.

4. The case study

This section contains a description of the case study based on the framework for understanding strategic data planning followed by an analysis of the case study using structuration theory. Within the case study description the institutional context is described first to enable understanding of the strategic conduct of the people involved. The unit of analysis of the case study is the data administration group and its interaction with project teams. The data administration group is located within the information systems department whilst project teams consist mainly of professionals from the information systems department together with some business users.

4.1. Case study description

4.1.1. Institutional context

4.1.1.1. Environmental context. The banking industry in Australia has been subject to great changes during the last 10 years. Since 1983 the Australian Federal Government has deregulated aspects of the banking and finance sector and approved the entry of foreign banks into the Australian market (Broadbent and Weill, 1993). These changes, combined with the severe economic recession of the early 1990s, have created a highly volatile and competitive banking environment. The banking industry in Australia is dominated by the four largest banks (Australia and New Zealand Banking Group, Commonwealth Bank, National Australia Bank, and Westpac) which account for 66% of the total assets held by Australian banks (KPMG, 1994). This case study concerns one of those banks.

The early 1990s was a difficult period for banks in Australia. Two of the four major banks suffered problems as a result of their loan portfolios, another merged with a smaller

bank which in turn had serious asset quality problems, whilst the fourth was affected to a lesser extent. Banks have reacted by focusing more on the management of non-performing assets, structural rationalisation and the reduction of operating costs (KPMG, 1994). Because data administration groups are essentially ‘infrastructure’ groups and not directly involved in systems development activities they are particularly susceptible to cost-cutting exercises (Simsion and Drummond, 1992).

Throughout the 1980s strategic data planning had been suggested by many industry leaders as a way of addressing the problems of data management. One of the most important outcomes of strategic data planning is the data architecture. Planning for, developing and implementing a data architecture generated a great deal of interest amongst large organisations (McGrath, 1993; Sager, 1988). In the early 1990s the development of a data warehouse became a popular issue within the information systems community (Inmon, 1992; McFadden, 1996). A data warehouse is a repository of information for decision makers which is sourced from data in many application databases. The data architecture is an important input to the design of a data warehouse (Inmon, 1992).

4.1.1.2. Organisational context. The bank in this case study had a strongly divisionalised structure, with separate business units representing the major areas of the business. There was considerable autonomy in the business units with responsibility dispersed in line with the decentralised organisational structure. The bank is well established in the industry and traditionally offered employees security and career development opportunities. However, the recession of the early 1990s affected the performance of the bank and between 1990 and 1995 staff numbers dropped by approximately 15% largely due to effects of the recession. The decentralised structure still continued, however, although some infrastructure activities such as personnel and technology services were integrated and centralised.

Consistent with the decentralised organisational structure, information systems decision making was strongly decentralised during the 1980s. Project approval and monitoring for most projects was delegated to a senior general manager or a general manager within the business units. For very large projects with a budget over \$1 million, approval and monitoring from a central expenditure review committee was required. Business units made autonomous decisions regarding hardware selection and software development. A centralised technology group was created in the late 1980s to focus on group-wide architectures and planning. However, the control of many information systems projects remained decentralised and within the business units.

4.1.1.3. Information systems context. In the 1980s each business unit had its own information systems group. There was a strong focus on the development of business applications within the business units and little coordination between the business units. The data administration consultant noted:

each business unit had its own IS proposals for similar systems. There was not a lot of cross pollination between the business units.

During the late 1980s a centralised information technology group was created for infrastructure activities. After the recession in the early 1990s most project work

undertaken was maintenance and ad hoc reporting, although a major customer-based information system and a data warehouse project were started.

There was no explicit policy on data ownership within the bank. The default position was that project teams were responsible for their local data definitions and data files.

A standard systems development methodology, purchased from a vendor, had been in use for many years. There was a commitment to the methodology and training and support structures were provided. The level of use, however, was at the discretion of the project leaders. Depending on the nature of the project, the project leader would select appropriate sections of the methodology to use. Project leaders were rewarded for projects which were successfully developed on-time and within budget.

4.1.2. Strategic conduct

4.1.2.1. Conditions for adopting and using strategic data planning. The centralised technology group recognised that there was a great deal of redundant data in the current applications systems. Incompatible data formats and naming conventions had made the consolidation of data for management information systems very difficult and time consuming. The data administration group manager noted:

we couldn't determine our total exposure to customers because they were spread across so many different systems.

A strategic data planning exercise was initiated because it would enable the development of integrated systems, lead to the elimination of duplicated data and enable easier consolidation of data for management information systems. The data administration group manager noted:

The original purpose of the data architecture was getting the data administration group to set out to reduce the duplication of data and get the definitions of data standardised across all systems.

4.1.2.2. Adopting and using strategic data planning. A small team was established in 1988 consisting of one bank employee and two experienced consultants. They met with an architecture review board of 14 people from various business units within the bank. The team met with the review board over a period of several months and completed the data architecture in 1989. However, the data administration group manager noted:

unfortunately a lot of those people were actually technologists that were in the business units; they weren't business people. The real business people were involved with business issues ... the right players weren't there.

The data architecture was represented using the extended entity-relationship notation. It was structured using the generalisation abstraction, and detailed textual descriptions and primary keys were included for each entity type. Guidelines for use of the data architecture were included as an addendum in the standard systems development methodology rather than as a specific step. Checkpoints were included in the methodology to enable the data administration group to review project data models to ensure that they were consistent

with the data architecture. Consultants from the data administration group were available to assist project teams with the data-modelling aspects of their projects. The data administration group manager noted:

[the systems development methodology] is a very process oriented, very difficult to use methodology and it would have adversely affected the data architecture use

A number of training seminars were held throughout the bank to explain the purpose of the data architecture and how it could be used during systems development. In addition a number of explanatory papers was distributed throughout the bank.

A data administration group was created in 1988 to manage use of the data architecture within the bank. It was located within the information technology infrastructure group. The manager of the data administration group was one level in seniority below that of the information systems project team managers. The group grew to a maximum size of 11 people including five data-modelling consultants and five people working on a corporate data dictionary. The data administration group was closed down in 1992 as business pressures led to a focus on short-term results. In 1993 a specialist data-modelling group was formed to support the development of a data warehouse. This group contained some of the people from the data administration group and made use of the original data architecture. The data warehouse project is continuing successfully in 1996, providing data for executive information systems, and thus achieving clear benefits for the organisation.

4.1.2.3. Consequences of adopting and using strategic data planning

4.1.2.3.1. Manager of information systems strategy. The manager of information systems strategy believed that the most important outcome of the strategic data planning exercise was the increased understanding of the data within the bank by all participants involved in the process. Although many of the objectives, including the development of integrated systems and elimination of redundant data, had proven to be impossible to meet, the concepts of data sharing and data as a corporate resource were well established within the bank. The manager of information systems strategy noted:

The most positive outcome from the strategic data planning exercise was better understanding of data within the bank. The data architecture is not as important as the organisational learning which has taken place.

The better understanding of data was an important factor in the development of the data warehouse. The data warehouse project was initiated after the strategic data planning exercise was completed and the data administration group had been closed down.

4.1.2.3.2. Data administration group manager. The data administration group manager felt that there was a lack of real understanding of what a data architecture was or what it could do for the organisation. Although there was strong support initially from senior management this dissipated as business pressures led to a focus on short-term results. In addition the task of strategic data planning was considered to be a large and difficult undertaking. The data administration group manager noted:

I don't think they really understood what a data architecture meant. They all understood that we would like to have a better management information system

but they didn't understand the implications of trying to implement such a thing. to do it in one hit was impossible.

the business people were wondering if it was a wiring diagram

The initial justification for the data architecture was largely based on long-term benefits. Expectations were raised to a high level and when the economic recession occurred management asked where the benefits of the data architecture were. None of the actual costs of implementing some of the potential benefits of the data architecture had been estimated. The data administration group manager noted:

It could never be justified on a cost justification basis. Things have to pay their way in the short term.

We kept promising all these wonderful things without pointing out what the costs were going to be to build such a thing ... with the common customer identifier, we should have been more honest up front and worked out some costs for implementation.

Use of the data architecture was counter-cultural to the way project teams operated and were rewarded. There was very little incentive for project teams to make use of the data architecture. Many projects were past the design stage and did not need data modelling. Other project leaders were not convinced of the merits of data modelling or data architectures. The data administration group was viewed more as a hindrance to systems developers than a help. The data administration group manager noted:

we forgot there was a corporate culture out there ... you had to understand the way people work ... the project leader is rewarded for delivering a project on time and within budget, not for complying with a data architecture.

In practice it was relatively easy for large projects to bypass compliance with the data architecture. Project leaders of very large projects had considerable political power. If they perceived that the data architecture might slow them down then they simply did not consider it. The data administration group was seen to be 'technically driven' and therefore viewed with suspicion. The data administration group manager was lower in the organisational hierarchy than most project managers and therefore had difficulty enforcing use of the architecture. The data administration group manager noted:

In theory they were not allowed to say they did not like it. In practice the project teams were powerfully supported and if they wanted to get you out of there it was quite easy to do.

4.1.2.3.3. Data administration group consultant. The data administration group consultant felt that although there was strong management support for building the data architecture there was no plan developed for its subsequent use. Project teams in particular did not have a clear understanding of the data architecture or its purpose. The data administration consultant noted:

What the architectures were and how they were going to help us, that was the most significant problem. It was a barrier that we never crossed.

There was a commitment by senior management in allowing the data architecture to be built, there was a commitment in establishing the data administration group, but after that it didn't quite work out.

I don't think it was seen as a change management thing, it was more of a matter of keeping up with the others. Everybody else had an architecture so we had better have one.

A significant problem raised by the data administration group consultant was that short-term expectations were raised too high initially and the data administration group could not possibly deliver the promised results. The data administration consultant noted:

In an attempt to show the benefits of data architecture we raised expectations in the short term too high, and we were judged against that and we just couldn't deliver.

Understanding the data architecture was also seen to be a problem. Because the data architecture was enterprise wide it contained many cross-functional concepts and therefore terminology issues arose. New terminology such as 'party' was introduced as a more general term for customer or supplier or business. Workshops held to explain the new terminology were largely ineffective. The data administration consultant noted:

we tended to use different terminology; that immediately alienated everybody.

a big problem was in getting people to accept that you could use a generic model to achieve specific needs.

Alterations to the methodology to include use of the data model were considered ineffective. An addendum which was added to the methodology was seen as yet another volume in a large methodology and there was confusion from some project leaders about where to find out about the data architecture. The data administration group was considered to be too small and to have too few skills. To be effective, data-modelling skills required by project teams must be immediately available.

After the data administration group was closed down the consultant became a key member of the smaller data warehouse design group. The warehouse was developed incrementally providing short-term, visible results. Because this group was able to deliver a specific tangible outcome it retained management support. The data architecture was an important input into the design of the data warehouse.

4.1.2.3.4. Project team leader. A major problem with data architecture and other infrastructure activities in times of economic recession was the lack of clear short-term benefits. A lot of the work which was underway did not involve database type work but was short-cycle time, urgent amendments. In those situations the data architecture was not particularly relevant. One potential area where the data architecture could be useful was in management information systems projects, in particular in sourcing data for the data warehouse. The project leader noted:

in a recessed economy people tend to shy away from infrastructure type work ... which doesn't necessarily provide a business benefit now. Business is not interested in it now.

The project leader viewed the data architecture as a theoretical idea for which the organisation was not yet ready. There was little incentive for project teams to use the data architecture. Because the data architecture was represented as a high-level generic model it was difficult to understand. The project leader noted:

The data administration group had a data architecture ... we weren't mature enough to cope with it at this point in time.

The reward for the project leader is to get the project in on time and within budget.

if you go to the high level data architecture which has a party and a contract you can make anything look like that if you want to.

The operation of project teams remained largely unaltered. The decentralised culture of the bank continued and project teams were strongly attached to business units. Project teams focused on local data rather than developing a shared data environment. The project leader believed that responsibility for application data should reside with the project teams. The project leader noted:

a lot of standards were put in place ... they would tick off bits that were applicable. That doesn't happen now ... We moved responsibility back to the project teams. We haven't necessarily made that clear enough. Distributed control.

4.2. Case study analysis

With strong initial management support strategic data planning was used to build a data architecture. A data administration group was formed to facilitate use of the data architecture by project teams and the systems development methodology was changed accordingly. However, three years later, management support for the data administration group and the data architecture had declined to such an extent that the data administration group was closed down. The data architecture subsequently was used for management information system applications and in a data warehouse project. This section uses the three modalities of structuration theory to analyse this process and explain why the changes occurred.

4.2.1. Interpretative schemes

The data architecture was not understood by many of the stakeholders in the systems development process. The architecture was represented as a structured entity-relationship model. This notation is used by data-modelling practitioners to represent semantic data models. Despite training courses in the notation there was little real understanding from the business people, some of whom likened it to a 'wiring diagram' rather than a conceptual model of their information requirements. This outcome is consistent with Periasamy's (Periasamy, 1994) case studies of information systems strategic planning which found that business management did not understand data architectures and considered them to be irrelevant. In addition the 'wrong' business people helped build the data architecture; the 'real' business people were too busy to commit the necessary time.

The lack of shared understanding of concepts in the data architecture can be seen as different structures of signification between the data administration group and business users. The language of data modelling is for information systems professionals rather than the general business community.

There was also difficulty within project teams in understanding the data architecture. Because a data architecture can be viewed as an attempt to define a set of generic, shared concepts which are common across the organisation there is little local context for project teams working at a lower level of abstraction and using familiar terminology. The manager of the data administration group thought that the use of 'different terminology' in the data architecture immediately alienated everybody and that it was a major problem getting project teams to accept that you could use a generic model to achieve specific needs. This is exemplified by the project leader commenting that if you use the high-level data architecture (which has the concepts 'Party' and 'Contract') you could make nearly any model fit. The concepts were too abstract to be useful. The lack of shared understanding of concepts in the data architecture can be seen as different structures of signification between the data administration group and information systems professionals in project teams.

This outcome is consistent with empirical studies by Hitchman (1995) and Goldstein and Storey (1990) which question the useability of conceptual data modelling amongst information systems practitioners. Despite a general assumption that entity relationship models are intuitive and easily understood and used by practitioners, they found evidence of poor understanding of some abstractions in entity relationship models. This case study finds evidence that terminology used in data models can also lead to poor useability.

Participation of stakeholders is important to the success of strategic data planning (Beynon-Davies, 1994). The outcome from strategic data planning of education about data and improved communication within the organisation by developing shared interpretative schemes is noted by Goodhue et al. (1992). In this case study, however, the key business people were not involved, and members of project teams expected to use the data architecture in systems development were not involved in the strategic data-planning exercise. Thus, although organisational learning occurred, it was not by appropriate stakeholders.

The data architecture was used, however, in the development of a data warehouse and for management information systems. These systems consolidate data from many business units and the data architecture provided a means of understanding how data from different business units could be sourced and consolidated. Expert data modellers from the data administration group who already had an understanding of the data architecture were involved in the design of the data warehouse. Other information systems staff involved were strongly motivated to use the data architecture due to the data-intensive nature of the data warehouse application and its span across business units.

The systems development methodology was changed to include use of the data architecture. However, the methodology was very large, difficult to use and 'process oriented' to begin with. The change to the methodology was accomplished by adding an addendum to the methodology and therefore was not well integrated into the methodology. After the recession, much of the work done by project teams was maintenance and ad hoc reporting. Project teams consequently found reference to the data architecture not particularly

relevant to much of the work they were doing and difficult to locate within the methodology. The methodology itself was understood by project team members using their interpretative schemes. Changes made to the methodology by the data administration group, however, were not successful in changing the structures of signification of the project team members.

4.2.2. Resources

The data administration group had checkpoints included in the systems development methodology to ensure that project teams used the data architecture. Consultants from the group were available to assist project teams when required. However, project teams perceived the data architecture as a 'technical' idea of little practical use that would slow their project down. Because they had 'considerable political power' they could easily bypass its use. In addition the manager of the data administration group was lower in the organisational hierarchy than the project leaders with no authority over them. The existing structures of domination within the organisation made the task of implementing the data architecture very difficult.

The centralising tendency of the data administration group in attempting to gain control over data modelling within project teams was clearly a structural contradiction to the highly decentralised and autonomous business units. Project leaders were rewarded for completing projects on time and within budget, not for adhering to the data architecture. The existing decentralised structure was reinforced by the actions of the project teams and no change to the structures of domination was achieved.

In order to gain management support for the strategic data-planning exercise and for the establishment of a data administration group, the potential benefits of the data architecture were 'oversold'. Clearly the establishment of a common customer identifier would have considerable benefits for the bank but in reality the task of implementing it would have been a huge and expensive undertaking. By raising expectations too high and then being unable to deliver results in the short term, the data administration group lost management support and was eventually closed down. From a structuration perspective this can be seen as an unanticipated consequence of intentional action.

4.2.3. Norms

The data architecture may be perceived as an attempt to introduce a new set of concepts with which to group the data that is used in business units. The new set of concepts includes such generic entity types as 'Party' and 'Contract' and global standards for data. The norm for business unit project teams, however, was to use the 'legitimate', local terminology rather than the new global standards. Only in the data warehouse and management information systems groups did terminology from the data architecture become the legitimate source of data definitions.

Local ownership of data was the norm for business units in the bank. The data architecture was viewed as a 'theoretical idea' with little practical use. Sharing of data or data definitions between business units was perceived by the business units as having few benefits and being an unnecessary overhead. The convention of local ownership and definition of data was not changed.

Industry standards of good practice in data modelling, including the use of structured entity relationship modelling and the centralised management of shared data definitions, were not adopted by project teams. Centralised approval for activities during systems development was not normal practice within the bank and considered an impediment to timely development of information systems. In general, project teams considered the costs of learning about and using the new approach to be far greater than the benefits. As a result the existing structures of legitimation were not changed.

5. Discussion and implications

In this section the case study findings are related to the problems in the literature identified earlier. The discussion focuses on how each of the problems can be explained using the structurational analysis and leads to a number of propositions about building and using data architectures.

5.1. *The data architecture is difficult to understand and communicate*

Mutual understanding among stakeholders is important to the successful implementation of information systems (Klein and Hirschheim, 1991; Myers, 1994). Both business users and information systems professionals in project teams had difficulty understanding the data architecture. Generic concepts in a global data architecture did not become part of their structures of signification. Whilst structured entity relationship models may be suitable for experienced data modellers they are probably not the most suitable language for business users and information systems professionals who do not regularly practise data modelling.

Encouraging participation in the process of strategic data planning is seen as a way of increasing understanding about the organisation's data and facilitating communication between business units. However, this was difficult to achieve with the top-down approach of strategic data planning where there is little short-term motivation for participants and the data administration professionals dominate the process. An alternative approach to building a data architecture which would achieve greater participation from stakeholders is an evolutionary approach. In this approach the data architecture is built incrementally by integration of data models from different business applications as they are built. A high-level, broad data architecture may be initially built to facilitate the integration of application data models, but very little detail is included in it. Only when there is a clear business requirement for an application system is a detailed data model built and incorporated into the data architecture. In this way, clear, short-term business benefits are realised and a data architecture is incrementally developed.

Much valuable information which is captured and used in the process of building a data architecture is lost in the final documentation. Of particular interest are informal information requirements (Darke and Shanks, 1996), scenarios (Carroll, 1995) which describe how the various concepts in the data architecture are used by participants (and in this way link abstract concepts in the data architecture to concrete business scenarios), and design discussions (Potts et al., 1994) which occurred as the data architecture was built. Stein

(1995) defines schemas and scripts as two mechanisms in retaining organisational memory. The data architecture is the schema and represents categories of information. The scenarios and design discussions are scripts which represent the process by which stakeholders use concepts in the data architecture and the process by which the data architecture itself was designed. Capturing and documenting this information together with the data architecture should help facilitate understanding of and communication about the architecture.

5.2. Sustaining management support for the data architecture is difficult

Management support is widely recognised as an important factor in the implementation of information systems (Myers, 1994). Although initial management support can be obtained through clear statements of existing problems and strong arguments about potential benefits, it is often short lived (Lederer and Sethi, 1991). In this case study the expectations of management were raised too high initially. Management's understanding of what strategic data planning could do for the organisation was therefore not realistic and the data administration group had little chance of achieving success. The raising of expectations high in order to gain management support had the unexpected consequence of ultimately leading to the loss of management support.

Business unit managers found the data architecture an abstract and theoretical idea of very little relevance to the business. The interpretative schemes of business unit managers and those of data administration professionals are significantly different. Business unit managers are more interested in the business benefits of data management than 'technical' details within the data architecture. Although many problems were identified with the organisation's data there was no clearly articulated objective which could lead to tangible results in the short term. An important implication of this is that data management initiatives should be linked to tangible business benefits which can be realised in the short term in order to sustain management support.

5.3. The data architecture is organisationally difficult to implement

The introduction of strategic data planning represents a significant organisational change. The migration from traditional development approaches to data-centred approaches requires both technical and administrative changes and perhaps restructuring of the information systems department. Organisations attempting to build and use a data architecture should take time to understand their informal organisational context (Beynon-Davies, 1994). Although it is vitally important to have sound technical knowledge of data modelling, the process of building and using a data architecture is very much an organisational issue.

Strategic data planning has a centralising tendency within organisations (Allen and Boynton, 1991; Goodhue et al., 1988). When business units have considerable autonomy in a decentralised organisation a structural contradiction may occur and resistance can be anticipated. Project leaders need to be rewarded for using the data architecture or they will resist using it. Goodhue et al. (1988) note that a change in information systems culture is required and 'incentive mechanisms must be changed to reward programmers for

conforming to a data architecture even if it involved additional time and resources'. Political problems concerning data ownership and sharing should be anticipated and planned for when undertaking strategic data planning (McGrath, 1993).

The data administration group leader was lower in the organisational hierarchy than the project leaders of project teams. It was relatively easy for project teams to bypass use of the data architecture during the systems development process. Trauth (1989) observed that a major problem with a data administration group is its 'lack of authority or status to match its level of responsibility'.

5.4. Strategic data planning may not be the best way to produce a data architecture

Strategic data planning may not be the best way to build a data architecture (Beynon-Davies, 1994). It is an expensive undertaking which can involve the time of many people for lengthy periods. Alternative approaches to building a data architecture should be considered and include using an industry standard data architecture and the incremental development of the data architecture using an evolutionary approach.

Industry standard data architectures are available for a number of industry sectors (Allworth, 1994; IBM, 1993). Although they have the advantage of avoiding the time necessary to design the data architecture, the organisational learning which accompanies the design process is lost (Stein, 1995). Extensive training and consulting support may be necessary to understand and use these data architectures.

The evolutionary approach to designing a data architecture involves the integration of business area data models. As data modelling is undertaken in application systems the data architecture is expanded. This approach is less expensive than the top-down strategic data planning approach and provides the opportunity for extensive participation by various stakeholders in the data-modelling process.

5.5. A balance between long-term and short-term benefits must be achieved

Strategic data planning is largely based on long-term benefits but short-term benefits are needed to sustain management support. Many of the benefits of strategic data planning, such as better design of databases within application systems, are difficult to identify and measure (Moody and Simsion, 1995). One problem identified by the data administration group was that project teams are rewarded for completion of projects on time and within budget rather than for compliance to the data architecture. Measures for benefits of using the data architecture and for compliance with the data architecture must be identified and applied in the performance reviews of project team members (Moody and Simsion, 1995). Data administration groups must also adopt a more pragmatic outlook and identify activities which will result in visible short-term results.

6. Conclusions

Organisations have had great difficulty with strategic data planning despite many convincing arguments which support its use. Strategic data planning is an important aspect of data management which aims to manage data as a corporate resource. Data management

enables the provision of accurate and timely data for strategic decision making. This study extends previous studies by using a process-oriented, interpretive case study approach to explain why strategic data planning is so difficult in practice.

A number of important implications have been identified which are of significance for practitioners and suggest areas for future research. These are:

1. Both business users and information systems professionals find the data architecture difficult to understand and communicate. Despite the widespread assumption that entity relationship models are intuitive and easy to use and understand this case study has explained why this is not the case with data architectures. Abstract concepts in the data architecture alienate potential users. Informal requirements, scenarios and design decisions taken during the design of the data architecture are important elements of organisational memory which should be documented and used to explain concepts in the architecture.
2. Strategic data planning may not be the best way to build a data architecture. A balance between the long-term goals of strategic data planning and the need for short-term benefits within organisations is difficult to obtain. Evolutionary approaches involving the integration of business area data models should be considered. New methodologies for the design and integration of functional area data models which include processes and representations for capturing informal requirements, scenarios and design decisions need to be developed. This is very important in facilitating communication and education about the organisation's data.
3. Strategic data planning and subsequent use of the data architecture involve complex organisational and social issues. Although management support for strategic data planning can be obtained, it is difficult to sustain due to the outcomes of strategic data planning which are long term, abstract and difficult to measure. The centralising tendencies of data administration, the political complexities of data sharing and the strength of existing terminologies, reward structures and routine behaviours within organisational groups are complicating factors which are frequently overlooked. An understanding of the organisational context within which the development and use of a data architecture will take place is critical to determining the most appropriate approach to use.

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