# CHAPTER 1

## 1. INTRODUCTION

### 1.1 RESEARCH MOTIVATION

There is considerable evidence that many organisations are constrained in their ability to realise their business objectives by their existing information systems. For example, Nolan et al. (1989: p.301) summarised the Bell (telephone) companies' difficulties with their information systems (as at 1988) as:

> The Bell System's early start in automation, coupled with its massive
> investment in computer systems, would appear to be a major
> advantage for the Regional Holding Companies in their new
> strategies. But this is not the case: on the contrary, their information
> technology is more of a liability than an asset with respect to their
> desired transformations.

The major reason identified for these difficulties was a lack of effective systems and data base integration. However, the Bell companies are by no means alone in having to confront their information systems' problems. Indeed, as detailed in Chapter 5, "Gigante Corporation" (the subject of the first thesis case study) faces similar problems and, in a 1990 survey, Doll Martin Associates (1990) identified 22 large Australian organisations that were attempting major transformations of their information systems environments.

One result of the above is that Strategic Information Systems Planning (SISP) studies have become increasingly popular in recent years. *SISP is defined as the process of: first, identifying a target information systems environment; and, second, planning the development of the target environment in detail. The information systems and architecture required to support an organisation's business strategy define the target information systems environment.* This is an extension of a SISP definition presented in DCE (1989). Other definitions reviewed, such as "SISP is an umbrella term for a great deal of work that must be accomplished to convert strategic systems concepts and ideas into reality" (QED, 1989: p.8), were considered less precise.

Despite the high level of SISP activity, however, the SISP implementation success rate has been poor (Lederer and Sethi, 1988; Sager, 1988b; and Doll Martin Associates, 1990). Furthermore, this problem is significant, since there is evidence that some organisations have invested millions of dollars in development and implementation of

their information systems strategies for little return (see, for example, BRW, 1991). Thus, this research was motivated by a desire to answer the question:

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Why has so much SISP implementation been
unsuccessful and what can be done to improve
this?
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The above constituted the broad research question. In the following section, the translation of this question into a more refined research question and detailed research hypotheses is summarised.

## 1.2 STATEMENT OF THE THESIS

Research strategy selection is discussed briefly in 1.3.2 and, in more detail, in 4.2. The initial stage of this study involved a review of the MIS and organisation theory literature and an exploratory case study. This led to the following conclusions:

- most SISP methodologies place considerably more emphasis on strategy development than on strategy implementation;

- while most methodologies recognise that strategy implementation can easily be derailed by "people" factors, little advantage has been taken of the considerable body of IS-related change management literature (see, for example, Markus, 1983; Leonard-Barton, 1988; and Lindner, 1989);

- in particular, resistance motivated by power and political issues has been established as a major cause of IS strategy implementation failures[1] and these issues must be given equal weight with economic and technical issues if the SISP implementation success rate is to improve;

- in general, information systems strategy implementors do not predict potential resistance well;

- the power model of organisation decision making (Pfeffer, 1981 and 1992; and Frost, 1987) and, in particular, the power source distribution model of Markus

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[1] In a recent survey of 22 large Australian organisations, Doll Martin Associates (1990) found that all had previously attempted to implement DCIMEs and all had failed. Technical and economic factors were proposed as the major cause of the failures but eight respondents nominated political factors as a contributing cause. Further evidence is provided by Weill (1989) who, based on a survey of IS strategy development and implementation in 33 manufacturing firms, concluded that firms with high levels of "political turbulence" were less likely to benefit from their IT investments.

(1983) represents a promising framework for the analysis of potential resistance; and

- many power source distribution model concepts and the SISP implementation domain are amenable to formal representation using commonly-used information analysis and artificial intelligence techniques.

Another activity undertaken during the initial research stage was the development of a power source distribution model called MP/L1 (Model of Power in First-Order Logic). Technically, the model was represented as first-order logic rules, around core data structures represented in entity-relationship form (Chen, 1976) and implemented as an advisory expert system in the logic programming language Prolog (Clocksin and Mellish, 1981). The preliminary conclusions were then translated into a refined research question and detailed hypotheses. These are presented in 4.3 and may be stated less formally as:

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To successfully implement an information systems
strategy, a thorough analysis must be undertaken
of the way in which power is distributed in the
organisation and the impact that the target
information systems environment will have on the
existing power distribution. The analysis must
be rigorous, in the sense that all sources of
potential resistance (resulting from loss of
power) must be identified and examined in a
structured and systematic way. This can be
accomplished through the application of the
power source distribution model MP/L1.
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The above constitutes the broad informal statement of the thesis. In the following section, the philosophical framework for the study is presented. Prior to this, however, some comments in support of the adoption of a technical approach to what is essentially a social science issue need to be made:

- first, the use of formal conceptual modelling techniques necessarily eliminates much of the ambiguity and concept overlap often found in models of organisation behaviour (which are typically presented as textual descriptions, possibly supplemented with diagrams). Thus, MP/L1 is precise and its semantics are clear;

- second, one conceptual modelling paradigm employed in MP/L1 is commonly used in SISP work to model much of the "hard" data collected (the organisation structure and parties, business functions, systems, information requirements and relationships between all of these). Modelling power/political data using the same approach reduces the possibility that "people" considerations will be treated as a peripheral issue only; and

- finally, the formal conceptual model can readily be automated. The automated implementation of the model can be used to ensure that the search for potential resistance is structured, systematic and complete.

## 1.3 PHILOSOPHICAL FRAMEWORK

### 1.3.1 The Nature of this Research

This research, indeed perhaps all research, has a significant applied component. The research takes as its starting point proven concepts developed by others and relies substantially on the strength of the power model of organisation decision making. It also takes advantage of proven concepts drawn from research and development activities concerned with logic-based expert systems technology. Finally, it uses two proof approaches. These are: first, statistical proof as used in laboratory experiments; and, second, inductive proof by case study. These activities, cast along the social science to traditional science spectrum of information systems, cross the boundaries of various accepted schools of thought. Hence, the need for a philosophical framework.

Borg and Gall (1989) have noted that an important function of research is to synthesise (often isolated) findings into powerful explanatory networks. Here, knowledge representation formalisms and methods used in information analysis, data base design and artificial intelligence are used to model key tenets of a widely-accepted theory of organisation decision making. The thesis extends organisation theory research through the use of a formal conceptual modelling approach which has not been previously employed in the domain under consideration (see 2.4). Conversely, information analysis and artificial intelligence research is extended through the application of formal conceptual modelling techniques to a new domain.

Thus, this research is cross-disciplinary. It encompasses elements of information analysis, artificial intelligence and organisation theory (specifically, power and politics, strategy development and implementation, and change management). In addition, since the

project demands that practitioners be taught how to apply a new conflict prediction method, there is an overlap with experimentally-based educational research.

In 2.2, a number of methods and technologies commonly employed in SISP work are identified. Some of these (for example, information analysis) have reasonably well-developed scientific bases. The same, however, can not be said of the total SISP process, which can be interpreted (as in DCE, 1989) as a meta-level concept which binds the individual planning tools together (for example, a SISP methodology typically advises on which tools to employ and in which combinations and circumstances). It could be argued that plans developed and implemented without a sound set of principles are doomed to give no sustained success because no means exist to understand why they succeed or fail, or indeed, no means exist to challenge the principles as a consequence of success or failure. This thesis is aimed at contributing to the development of a reputable scientific base for SISP (specifically, for that part of the SISP process concerned with strategy implementation).

Related to this, Benbasat et al. (1987) have argued that a pressing need in information technology research is to "open the black box". That is, organisational processes must be examined in much greater detail in order to come to a better understanding of the effects of information technology on the people who work with it and vice versa. Here, by focusing on information systems processes, organisation parties, power sources and relationships within and between these, the aim is to gain a greater understanding of the SISP implementation "black box".

Finally, this research encompasses the three traditional phases of the scientific method; exploration, hypothesis generation and hypothesis testing (Campbell and Stanley, 1963). First, SISP implementation was explored in detail in order to develop a detailed description of the phenomenon. A further outcome of this exploration phase was the refinement of the broad research question into the specific hypotheses presented in 4.3. The remaining research phases were concerned with testing these hypotheses.

## 1.3.2 Research Strategy Selection

Benbasat (1984) has noted that no one research strategy is appropriate in all situations. Research strategy depends on what is critical to success, which varies with the domain of the research. In inter-disciplinary research, well understood and accepted critical issues that define a school of thought or discipline do not exist. Hence, formulating the approach and context for research requires attention. For example, case study and laboratory experiment are two approaches that are not feasible and acceptable in all

disciplines. In addition, some research projects may demand the use of multiple strategies (Benbasat et al., 1987). This is the case here, where research goals are pursued through two case studies and a laboratory experiment.

Many authors (for example, Roethlisberger, 1977 and Benbasat et al., 1987) have noted that case studies are well-suited to the tasks of exploration and hypothesis generation. This applies particularly to the information systems field, where researchers often find themselves trailing behind practitioners in proposing and applying new techniques (Benbasat, 1984). Thus, the first stage of this project involved a case study for purposes of exploration, description and hypothesis generation.

Hypothesis testing was accomplished through a combination of a laboratory experiment and a second case study (a field test). Essentially, hypothesis testing involved comparing the conflict prediction effectiveness of the model developed in this research project against whatever other methods are employed in SISP implementation. This demanded tight control over independent and extraneous variables. Hence the second stage involved a laboratory experiment, for the purpose of initial hypothesis testing. Analysis of data collected during the laboratory experiment was largely quantitative, using statistical techniques.

A recognised weakness of laboratory experiments, however, is the difficulty of generalising findings to other settings (Borg and Gall, 1989). Consequently, during the second stage of model validation, a further case study (in the form of a field test) was undertaken to assess the external validity of the laboratory experiment findings.

Yin (1984) has argued that, while most case studies focus on exploration and hypothesis generation, a single case study can be used to test a hypothesis provided it represents a "critical case". The second case study meets Yin's critical case criteria. Data evaluation in the second case study was both quantitative and qualitative and employed Markus's (1983) criteria of assumption applicability and prediction accuracy.

The requirement of uniform assumptions and context systematically applied is relatively easy to satisfy in a well understood quantitative science. The experience of the experimenter can be judged from the quality and repeatability of the experimental work because repeating experiments is feasible. It becomes less easy as the scientific judgements required are more qualitative and the expense, time and context needed becomes formidable. In such areas, the researcher must have gained sufficient experience to be able to recognise context and assumptions in the particular. The

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question of how well judgements are made in the particular is the bane of the case study and the major difficulty with experiments requiring qualitative judgement.

Thus, in case study research, the design and maintenance of a *case study data base* assumes major importance. In particular, the data base must maintain a "chain of evidence", so that a reviewer can conveniently trace conclusions to supporting observations and documentation (Yin, 1984). The case study data base design employed in this research is presented in 4.4.2. A significant feature of the approach employed is the conceptual level representation of the data collection domain in entity-relationship form.

In selecting the second case study, a "replication logic" was employed (see 4.2). Yin (1984) has argued that multiple cases should be treated as multiple experiments and that cross-experiment (rather than within-experiment) design and logic are appropriate. This is in contrast to what he claims is a mistaken analogy, where a "sampling logic" is employed and multiple cases are equated with multiple respondents to a survey or to multiple subjects within an experiment.

Finally, it should be noted that, technically, the two case studies are examples of action research (Avison, 1990), in that the researcher was an active participant in strategy implementation. The recognised major weakness of action research is that active participation may lead to a lack of objectivity in data collection. Steps were taken to minimise this difficulty and these are detailed in 4.5.3 and 4.6.2.

## 1.4 THESIS OUTLINE

The thesis is organised as follows. In Chapter 2, the conceptual framework for the thesis is presented and arguments are advanced for the centrality of the power concept. The detailed formal specification of MP/L1 is then presented in Chapter 3. Chapter 4 contains the research design, where issues introduced earlier in the philosophical framework are expanded upon, the formal research hypotheses are presented and the experimental and field test designs are detailed. Chapters 5 and 6 respectively contain case study reports of SISP implementations at "Gigante Corporation" and "South-Western University" (SWU). As noted in 1.3.2, the first case study (Gigante) was exploratory and the second (SWU) was carried out to field-test the extent to which the experimental findings could be generalised. Experimental and field test results are presented and analysed in Chapter 7 and, finally, in Chapter 8, the study is summarised and directions for further research are indicated.

# CHAPTER 2

## 2. CONCEPTUAL FRAMEWORK

> There is nothing more difficult to plan,
> more doubtful of success, nor more dangerous
> to manage than the creation of a new system.
> For the initiator has the enmity of all who
> would profit by the preservation of the old
> institution and merely lukewarm defenders in
> those who would gain by the new one.
>
> Machiavelli (1513)

## 2.1 OVERVIEW

In this chapter, the conceptual framework for the thesis is presented. Key concepts are dealt with in more detail in later chapters.

Background on Strategic Information Systems Planning (SISP) is presented in 2.2 followed by an introduction to the power model of organisation decision making in 2.3. Power model concepts are expanded in the MP/L1 specification presented in Chapter 3. Related work on automated models of decision making is introduced in 2.4 followed, in 2.5, by a discussion on data-centred information management environments (a type of strategic, target, information systems environment that constrains the scope of this research). The chapter concludes with a summary.

## 2.2 STRATEGIC INFORMATION SYSTEMS PLANNING

The information systems functions and architecture required to support an organisation's business strategy define the target information systems environment. SISP is described as the process of: first, identifying the target information systems environment; and, second, planning the development of the target environment in detail.

Traditional information systems analysis approaches, such as Gane and Sarson's (1977) Structured Systems Analysis, can be employed to good effect in SISP work. SISP, however, is concerned with two important areas not given proper emphasis in the traditional approaches. These are: first, the emphasis on aligning an organisation's

information systems with its broader objectives, strategies and external environment (McFarlan et al., 1983; Parker, 1985; Boynton et al., 1987; and Broadbent, 1990); and, second, on the need to identify opportunities where information systems might be used for strategic advantage (Porter, 1980 and 1985; Porter and Millar, 1985; McFarlan, 1984; and Sager, 1988a). Most works addressing alignment and competitive advantage recognise the overlap between the two issues. As has been noted by Broadbent (1990), information systems should ideally support business strategy but information systems based competitive advantage can drive business strategy.

The classic examples of strategic uses of information systems include the reservations systems of American and United Airlines, the order entry system of American Hospital Supply and the cash management account system of Merrill Lynch (Barrett, 1986-87). Contrary to fairly widespread belief, however, competitive advantage in these cases was not accomplished through sophisticated decision support systems but through the well thought out integration of routine transaction processing systems (Kim and Michelman, 1990). This research is focused on the implementation of information systems strategies that include a very high degree of (operations-level) systems integration as a key objective.

A variety of SISP approaches have been proposed and are in popular use. Popular frameworks, methodologies and techniques include Nolan's "Stages" framework (Nolan, 1977), Porter's "Competitive Forces" framework (Porter, 1979), Rockart's "Critical Success Factors" (Henderson, et al., 1984), the "Strategic Planning Framework" of McLean and Soden (1977), "Business Systems Planning" (IBM, 1984) and the "Lancaster Soft Systems" planning approach (Wilson, 1984).

A review of SISP methodologies has revealed that they tend to be stronger on strategy development than on strategy implementation. Typically, implementation issues are discussed in terms of project identification, project dependencies, technical issues and IS Department organisation structures (see, for example, Martin, 1982). It is true that most methodologies do recognise that strategy implementation can easily be derailed by "people" issues but little advantage is taken of the considerable body of IS-related change management literature (see for example, Markus, 1983; Franz and Robey, 1984; Johnson and Rice, 1987; Leonard-Barton, 1988; and Lindner, 1989). Where advice on people issues is provided, it tends to be largely insubstantial and presented in terms of simple heuristics; for example, "get senior management involvement and support" and "ensure that a member of the dominant coalition is on the SISP team" (DCE, 1989).

The above helps to explain why many information systems strategies have not been successfully implemented. *In a survey of SISP implementations in 80 North American organisations, Lederer and Sethi (1988) found that only 24% of all projects recorded in SISP plans had been successfully implemented. Sager (1988b) and Doll Martin Associates (1990) point to similar results within the Australian context.* Consequently, a starting point for this research is that people issues must be given equal weight with other organisational, economic and technical issues if information systems strategies are to be implemented as intended. Furthermore, it is maintained that the power model of organisation decision making (Pfeffer, 1981 and 1992; Markus, 1983; Frost, 1987; and Provan, 1989) provides an appropriate framework for this wider consideration. In the following section, arguments to support this contention are presented and relevant concepts from the power model literature are introduced.

First, however, some important ways in which information systems strategy implementation differs from the implementation of individual systems are noted.

Broadbent (1990) has defined information strategy as "patterns in a series of actions aimed at strengthening the performance of information resources, information technology and personnel in order for the organisation to succeed in its industry". Typically, then, a SISP implementation plan will identify many activities (or projects) and will specify project sequences and inter-dependencies. Thus, SISP implementation is more complex than implementation of an individual system. Also, implementation activities will be linked by a number of common threads (for example, conformance to technical, information and financial objectives). While, on the one hand, multiple activities could create political opportunities (for example, trade-offs), the requirement for conformance may work against this. Finally, an information systems strategy will often encompass issues, such as technical and organisation infrastructure establishment and development, project approval mechanisms and funding directives. Each of these issues has received attention in the literature but, most often, in isolation (for an integrated treatment see McFarlan et al., 1983). Again activity inter-dependencies add to complexity.

## 2.3 THE POWER MODEL OF ORGANISATION DECISION MAKING

### 2.3.1 Concepts of Power

There are a variety of approaches and disciplines concerned with people issues and information systems that range from modelling user behaviour, industrial relations and

labour concerns, to ergonomic considerations and legal dilemmas. In this, much emphasis is evident on micro-behavioural aspects of people and information systems.

However, as argued by More (1990), such a focus is inadequate because it fails to take account of the broader context within which implementation occurs. Quite simply, a focus that places people issues squarely within the complex technical, economic, political and cultural realities of organisation life is required. As Tichy (1987: p.66) has argued:

> The key to managing strategic change and making an
> organization effective is to align an organization's components -
> its mission and strategy, its structure, and its human resources -
> within the three technical, political and cultural systems and to
> align each of these systems with the other.

In emphasising technology, politics, and culture, Tichy reveals a set of assumptions or theories of understanding how organisations work. These are reflected again more recently by Bolman and Deal (1991), who outline four major ways or frames for understanding organisational life:

- The structural frame aims to develop organisation structures consistent with an organisation's mission, its strategy and environmental constraints. Emphasis is placed on organisational goals, roles, technology and economic factors;

- The human resource frame aims to create a better fit between the individual and organisation in terms of needs, skills and values;

- The political frame aims to develop political skill and acumen, focussing on power, conflict and the distribution of scarce resources as the central issues; and

- The symbolic frame aims to improve organisational functioning by moving outside the assumed rationality of the other frames, highlighting the cultural and theatrical dimensions of organisations. "Culture" is defined as a socially defined framework for thinking about reality. It constructs the ideologies for its members by symbolising the correct rules and language to be used to achieve shared membership and is characterised by a system of beliefs.

Any major information systems organisational change involves all four frames. There will be structural realignment, psychological and emotional impacts on individuals,

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conflict and power struggles among those who benefit and those who do not, and loss of meaning and cultural reinterpretations for many.

In this thesis the focus is on the political frame, linking the significance of management information systems and information systems strategy to power in organisational processes. In the remainder of this chapter, arguments are presented in support of the centrality of power and politics in information systems activities. Pfeffer's, now classic, comprehensive treatment of power within the organisational context (Pfeffer, 1981) is taken as a starting point.

Pfeffer (1981: p.7) defines *power* as "a force, a store of potential influence through which events can be affected", while *politics* "involves those activities or behaviours through which power is developed and used within organizational settings". He describes power as "a property of the system at rest" and politics as "the study of power in action".

Pfeffer's stores of influence are *power sources* (examples of which are control over information flows, position in the communications network and expert knowledge). Power sources are treated more comprehensively in the following chapter but, for now, it is sufficient to note that many organisation decisions may result in a redistribution of power sources, in which case there will be winners and losers and losers may *resist* change. It is this concept that is at the heart of MP/L1 and, while resistance is not automatic, Pfeffer contends that it is likely: 1) where there is disagreement about goals and objectives; 2) where uncertainty exists about the means required to achieve objectives; 3) where resources are scarce; and 4) where decisions are important. It is maintained that all these are characteristic of SISP implementation.

Because of the necessity to constrain the research effort to a manageable scope, this thesis is concerned primarily with predicting resistance (or conflict[1] ) rather than with tactics that might be employed to counter resistance. Nevertheless, extending MP/L1 to include a tactics component has been identified as an important area for further research. Thus, an overview of tactics is presented in 2.3.4, the MP/L1 specification (contained in 3.4) includes a high-level specification of a tactics component and the case studies (presented in Chapters 5 and 6) include a review of change management tactics employed. Furthermore, it should be noted that structured and comprehensive resistance prediction is itself a political tactic.

It should be noted that MP/L1 is concerned with *potential resistance*. A party threatened with a loss of power may choose not to resist for a number of reasons. Some of these are

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[1]  In this thesis, an act of resistance is treated as an instance of a conflict between a resistor and a strategy implementor (formal definition in 4.3.2).

consistent with the concept of self-interest that is at the core of the power model and include involvement in coalitions and trade-offs and ignorance of potential threats (Pfeffer, 1981). However, some parties may be prepared to sacrifice their own interests for corporate goals. This is most likely in what Vilojen (1991) refers to as "strong culture" organisations which are characterised by shared attitudes, beliefs, values and goals. Also, just as a loser in a power source redistribution may not resist because of ignorance of a threat, a winner may resist if unaware of the effects of the power redistribution. This does not lessen the potential usefulness of MP/L1. On the contrary, an MP/L1 analysis will equip a change agent with information that can be employed to good effect in dealing with this type of resistance. Specifically, the change agent will be able to enlighten the resistor with details of potential gains from the change initiative.

In common with Pfeffer (1981) and Markus (1983), the view is taken here that resistance is neither good nor bad and that, in uncertain situations, resistance may well be the result of reasonable concerns rather than self-interest. Thus, while MP/L1 is designed to assist strategy implementors in predicting resistance, all resistance should be examined from power-political and rational choice perspectives. That is, much resistance will result from threats to power sources but it is also possible that the strategy has flaws and can be improved upon.

One consequence of the above is that strategy development and implementation should not be treated as discrete consecutive activities, but should be integrated. Provan (1989) has argued that internal organisational power aspects must be an input to strategy development to ensure that any strategy (developed from a rational-choice perspective) is realizable. Conversely, resistance encountered during strategy implementation may have a sound rational basis and, perhaps, is an indication that elements of the strategy resulted more from power plays (among developers) than from logic-based processes.

Some authors (see, for example, Stephenson, 1985 and Carnall, 1986) distinguish resistance from *opposition*. According to this classification, opposition comes from those with access to decision making and resource allocation mechanisms and articulates the views of parties in positions of influence while resistance is defined as a diffuse, unstructured and emotional activity, employed by subordinate parties excluded from opposition tactics. In MP/L1, although no explicit distinction is made between opposition and resistance (both types of activity being called resistance), specific acts of resistance might be classified as one or the other by reference to the power source network presented in Figure 3 of 3.4.3 (for example, opposition might occur where a SISP implementation activity threatens a party's authority over an information provision process).

Authority is closely related to the organisation "traditions" discussed by Provan (1989). An example presented is departmental power, where the central role of some departments in decision making is unquestioned in other parts of the organisation. Lindner (1989) referred to much the same concept as "habits", described as rules and interpretations of reality that can be used to influence decision making, and Carnall (1986) has proposed that "dominant views" must be usurped when implementing organisational change.

One particularly useful approach is that of Frost (1987) who proposed a two-level power structure, where habits, traditions and dominant views, described as "systems of influence", are a source of *deep structure* power; a power source derived not from *surface level* dependencies between organisation actors, but from sociohistoric processes within the organisation. Frequently, systems of influence work to perpetuate an unequal distribution of power (when assessed at the surface level). Pfeffer (1981) has noted that organisation "norms" make the exercise of power expected and accepted and, effectively, identifies authority (institutionalised power) as a specific system of influence. MP/L1 employs the two-tier structure proposed by Frost and shows deep structure power being exercised through the manipulation of organisational rules that represent dominant beliefs and values (see 3.4.3).

Finally, in recent years, much attention has been focused on power derived from information. In particular, strategic uses of information and information systems have generated much interest (see, for example, Porter and Millar, 1985). Pfeffer (1981) has nominated control over information provision as an important source of power in organisations; a power source which encompasses an actor's position in the communications network, the ability to set goals and constraints and to control agendas and the provision of selective information. According to Vilojen (1991: p.277): "It is often the case that divisional managers are at an informational advantage ---. They are more knowledgeable about the facts of the specific case and can present (manipulate or distort) these facts in a wide variety of ways."

Kim and Michelman (1990) have observed that systems integration efforts may be threatened by "proprietary information" claims. Lucas (1984) has identified a number of power sources derived from information systems and Markus (1983: p.442), in reporting on the information systems case study referred to earlier, observed: "Access to information is probably less important as a basis for power than the ability to control access to information or to define what information will be kept and manipulated in what ways."

Control over access to information systems can only be realized by parties with information systems knowledge. This is a form of "meta-knowledge" and the importance of meta-knowledge as a power source has been emphasised by Toffler (1990: p.277) as: "--- the struggle for power changes when knowledge about knowledge becomes the prime source of power."

The role that "gatekeepers" play in controlling access to information has received considerable attention in the literature (see for example, Whisler, 1970 and Pfeffer, 1981). Markus's (1983) work is particularly pertinent to this research in that she has graphically illustrated just how important information systems responsibilities, such as approving data base access and specifying systems functionality, can be in the wider organisational context. Again, this is elaborated in the next chapter.

## 2.3.2 Rational Choice Models

As suggested in 2.3.1, the political frame is a viable perspective to adopt. However, it must be conceded that, within the organisation theory literature, the rational choice model of decision making[2] (Allison, 1971) has been the dominant paradigm.

Pfeffer (1981: p.2) acknowledges this but contends that important reasons for this are: first, that the power model does not conform to socially held views of rationality and effectiveness; and, second, that "the concept of power is troublesome to the socialization of managers and the practice of management because of its implications and connotations." In addition, Pfeffer (1978, 1981 and 1982) and Pfeffer and Salanik (1978) have argued that political considerations dominate rational choice considerations in decisions involving allocation of resources, design of control systems, methods of performance appraisal and, importantly, the adoption of new technologies.

The dominance of the rational choice model has also been questioned by Galbraith (1972) in his controversial work in which he argues that, in modern corporations, power rests with the "technostructure" and that it is the pursuit of their goals and objectives (rather than stated corporate goals) that is the principal force that drives organisations.

Mackenzie (1986) has also argued the case for the power model by focusing on discrepancies between the way organisations are supposed to operate and what actually

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[2] Essentially, in rational choice decision making, organisations have goals and the sum of those goals is the preferred state of the world. Search is undertaken until the option that best satisfies the goals is found.

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occurs. Importantly, he points to field research conducted in many firms, in a wide variety of industries, in support of his argument. At the same time though, he notes that a weakness of much research into the power model is an over-reliance on formal position and task statements and organisation charts.

Further empirically-based support for the use of the power model in the information systems domain has been provided by Weill and Olson (1989). In analysing the results of six "mini case studies", addressing the relationship between level of investment in information technology and firm performance, they conclude that *"the political and power processes in organizations play a major role in information technology investment decisions, often eclipsing technical and economic considerations."* In a more comprehensive follow-up study, addressing the same question in 33 manufacturing firms, Weill (1989) concluded that firms with high levels of "political turbulence" were less likely to benefit from their information technology investments.

Kling is another to have queried the efficacy of the rational choice model and, in a paper highly relevant to this research (Kling, 1980), has demonstrated that some information systems are partially (if not totally) intended to achieve non-rational purposes. Markus (1983) has extended Kling's work by focusing on explanation capabilities. Specifically, in investigating the implementation of an integrated financial information system in a large organisation, she has demonstrated that a joint rational choice and power model analysis can be used to explain acts of resistance in a way much more useful to the practitioner than explanations generated from a rational choice perspective alone. In a later work, Markus and Bjorn-Andersen (1987) have observed that the integration of isolated systems, in particular, is a task fraught with political difficulties. Specifically, they note that because the integration task cuts across organisational boundaries, changes in work-flow, communication patterns and control processes may lead to a significant shift in the organisational balance of power.

Following the tradition of Markus's "dual perspective" analysis, an important recent development is the "holistic" approach to strategy development (and implementation), proposed by Waema and Walsham (1990), in which strategy development is seen as containing elements of both rational choice and power behaviours. This approach is an extension of Quinn's work on "logical incrementalism" (Quinn, 1980), where strategy formulation is described as a jointly analytical and behavioural process with executives moving "flexibly and experimentally from broad concepts to specific commitments". The holistic approach subsumes, rather than denies, the power source concepts that underpin MP/L1.

Thus, new information systems must not only satisfy economic and technical criteria for success but be politically feasible as well. Much political activity is concerned with the development and protection of power and new information systems change existing sources of power. The view presented here is that, to successfully implement an information systems strategy, a thorough analysis must be undertaken of where power lies in the organisation and the effect that the new information systems environment will have on redistributing that power. If this is done, those who will gain and lose power can be identified so that support and resistance based on political considerations alone can be anticipated. Resistance is to be expected primarily from those who will lose or perceive they will lose) power. As change agents, SISP implementors need to be able to factor the results of power source redistribution analysis into their consideration of encountered resistance (which will often take the form of technical or economic arguments). Also, while organisation restructuring is not our primary focus in this paper, power source redistribution data is essential input into strategy and organisation structure alignment considerations.

Finally, political influences on information systems activities may appear as discordant to some IS managers as political influences on the application of economics was to traditionalists when political economy was first proposed in the early 1970s (Galbraith, 1972). Bowman and Asch (1987), however, have argued that very few strategic planning decisions result from pure rational choice processes and that, in uncertain situations, decisions must be arrived at by other methods. Moreover, Pfeffer (1981) contends that uncertainty leads to political activity. Much information systems decision making is made uncertain by the flimsy scientific base on which the immature discipline rests and it is therefore imperative that power and political considerations be taken into account in SISP work. MP/L1 is a strategic management tool that allows a SISP implementor to include the critical factor of resistance to change within the total management of the SISP process.

## 2.3.3 Power Based Models

The model presented in the following chapter is prescriptive as well as descriptive. Change agents may employ the model to assist in identifying areas of potential resistance, resulting from activities that cause changes in organisational power source distributions. Predicting resistance though, is not a trivial task, in that useful results depend not only on nominating potential resistors but also on specifying the reasons for (or types of) resistance. Kotter and Schlesinger (1979: p.107) emphasise this point as follows:

Organisational change efforts frequently run into some form of
human resistance. Although experienced managers are generally
all too aware of this fact, surprisingly few take time before an
organizational change to assess who might resist the change
initiative and for what reasons. Instead, using past experiences as
guidelines, managers all too often apply a simple set of beliefs -
such as "engineers will probably resist the change because they
are independent and suspicious of top management." This limited
approach can create serious problems. Because of the many
different ways in which individuals and groups can react to
change, correct assessments are often not intuitively obvious and
require careful thought.

Mackenzie (1986), in questioning the practical usefulness of the mutual dependence
concept (Emerson, 1962) fundamental to much research into the power model, has
proposed the idea of a "structured cascading of uncertainty and dependency". An
implication of this is that, unless links between organisation parties, processes and
resources are first established, a change agent will face considerable difficulty in
assessing the potential impact of any initiative. In the MP/L1 model presented here,
these linkages are represented, as well as relationships between power sources. Thus, for
any change initiative, the model will predict not only the more obvious areas of potential
resistance, but also consequential resistance. This is important because many
organisation actors will jealously guard some power sources, yet be relatively
unconcerned about others (Pfeffer, 1981). Knowledge of sources of consequential
resistance is essential if a change agent is to choose appropriate tactics.

An early step in predicting resistance must be the identification of relevant parties.
Parties might be individuals, sub-units, organisation units (for example, departments) or
coalitions of these. Various clustering techniques used in network analysis (see 2.4)
would appear to be particularly well-suited to the task of party identification.

In addition, Pfeffer (1981) has suggested a useful mechanism which relies on mapping
issues against known (or assumed) attitudes of possible political actors to the issues. The
resultant matrix allows groupings to be readily identified. An important feature of this
mechanism is that it is based on the implicit assumption that the power of organisation
actors is not general, but issue-specific.

Provan (1989), in presenting his "power-strategy" model, takes organisation departments
as his critical unit of analysis. Ignoring the important role of the outside expert (Pfeffer,

1981), this dissection may be appropriate for strategy formulation but is too broad for strategy implementation (where a much more finely-grained analysis is required if all potential areas of significant resistance are to be identified).

Also, a party may correspond to what Mackenzie (1986) has referred to as a "virtual position", where three or more people from different parts of an organisation work together on some important recurring task. Virtual positions are prevalent in information systems domains (particularly where, if systems and data are not integrated, they represent an important means of coping with change). That is, many events (for example, regulatory or organisation policy changes) may necessitate that amendments be made to several systems with overlapping functionality and data. Typically, the necessary coordination will be managed by a virtual position, with a membership drawn from stakeholders in the affected systems. In time, the one stakeholder may become part of many virtual positions.

## 2.3.4 Decisions and Change

Leonard-Barton (1988) has described a general framework which may be employed to guide a change agent in selecting tactics for implementing technical innovations. Her framework is based on the concept of "implementation characteristics" which are, essentially, organisational and technology attributes that both constrain change agents and present them with opportunities (c.f. Markus, 1983, and her technology/people interaction theory). Importantly, while Leonard-Barton's framework is somewhat deterministic (in that combinations of implementation characteristics suggest certain generic strategies), her approach is underpinned by the principle that no one tactic is appropriate in all situations. This point has also been emphasised by Kotter and Schlesinger (1979), Pfeffer (1981), Markus (1983) and Mackenzie (1986).

The three broad implementation characteristics identified by Leonard-Barton are:

- *transferability,* meaning the extent to which a technology has been proven (preparedness) and the degree to which operating principles can be communicated to end-users (communicability);

- *implementation complexity,* meaning both the number of people impacted by the new technology (organisation span) and the number of organisation units impacted (organisation scope) and

- *divisibility,* meaning the extent to which a new technology can be phased in -
either by partitioning the technology (modularisation) or the organisation
(individualisation).

Successful implementation of a technical innovation is more likely where transferability
is high, implementation complexity is low and divisibility is high. To some extent this is
intuitively apparent. In addition, some empirical support is provided by a research
project involving case studies of the implementation of different types of technical
innovations in 14 separate organisations (Leonard-Barton, 1988).

Reference has already been made to the high SISP implementation failure rate (see 2.2).
The above helps to explain this phenomenon, given that (at least some) elements of
many SISPs have not been well-proven in the field and that, in general, a SISP will have
an impact on most organisation units and employees. On the other hand, because a SISP
consists of many (tightly and loosely related) projects, astute implementors can often
employ partitioning tactics to good effect.

One generic strategy suggested by Leonard-Barton (particularly appropriate where low
transferability and high implementation complexity apply) is the use of a "champion",
which is one of three change "anchor" types proposed by Lindner (1989); the others
being a compelling deadline and a commonly agreed direction. Whatever the anchor
though, it must provide sufficient credibility to sustain the change process until it gains a
life of its own. Choice of an anchor should be determined by the organisation's familiar
mode (its habits and values) and by the immediate environment. For example, if an
organisation habitually makes one person accountable for a task and, if one person
appears to be naturally stronger than others, a champion-based change process might be
employed.

Lindner emphasises, however, that the three change anchor types are not equally
efficient and that the anchor might have to change over time. Frost (1987) and Porter et
al. (1981) have also stressed the need for flexibility in suggesting that the direction of the
influence attempt (upwards, downwards or lateral) should be a prime determinant of
tactics employed. It is considered that multiple change anchors and a variety of tactics
are essential for SISP implementation, which usually involves a lengthy timetable and
multiple activities (projects).

Tactics must be chosen with particular care where deep structure power is involved.
Carnall (1986: p.109) has asserted that "Dominant views must be usurped ----" and has
proposed a 5-stage process to explain how existing beliefs, values and attitudes might be

replaced. Frost (1987) has put forward a 4-stage model, which is similar to Carnall's with its emphasis on learning. Frost, however, while emphasising the dangers inherent in challenging established systems of influence, also stresses that the change agent can use them to advantage. The implementation of the celebrated expert system, XCON (McDermott, 1981), provides an excellent example where, according to Leonard-Barton (1988: p.622), "XCON survived only because its sponsor ---- could remind his superiors, via an outspoken memo, that the company culture had always encouraged and thrived on risk taking".

Frost (1987: p.532) has stated that "distortion of communication is the central focus of political action in the deep structure game" and that alternative viewpoints can be neutralised through devices such as abstract quantitative formulae. Many other researchers have addressed the role that language plays in political activity. An illustrative example is provided by the following excerpt from the (fictional) "Yes Minister" diaries of Lynn and Jay (1981: p.19):

> I explained that we are calling the White Paper *Open Government*
> because you always dispose of the difficult bit in the title. It does
> less harm there than on the statute books. It is the law of Inverse
> Relevance: the less you intend to do about something, the more
> you have to keep talking about it.

Pfeffer (1981) has asserted that language is the vehicle through which decisions made by power holders are rationalised and justified; that political language is often couched in emotional and evocative terms; that many people will accept assertions couched in political language if they are repeated often enough and that language can be used to dull the critical facilities rather than sharpen them (see also Edelman, 1977). Drake and Moberg (1986) have explored the link between language and symbols (an example of a symbol being a system of influence expressed as a simple phrase) and Alter (1989), in his useful analysis of the advantages and pitfalls of employing systems integrators, has underlined the importance of "sending the right message to the organisation".

Frequently, though, the "right message" is ambiguous. Lindner (1989) has noted that ambiguity is often a useful tool in implementing change programmes, but information technology initiatives often demand that ambiguities be eliminated. This, she has suggested, is an important reason why much information systems activity is intensely political. A further important point made by Lindner is that, if not managed properly, *implementation of a computer system can create instant incompetence among staff well-experienced in carrying out their tasks in the old way.*

Often, considerable difficulty is experienced in managing new patterns of communication dictated by the introduction of a new information system and, indeed, it is a rare event where an operations-level information system has an impact on only one organisation unit. Coalition formation is an appropriate political tactic where lateral relationships are involved (Frost, 1987) and where there is strong organisation unit inter-dependence (Pfeffer, 1981).

Pfeffer (1981), however, has warned that, despite the extensive theory of coalition formation, not all of this is appropriate within the organisational context. He refers to the work of Bucher (1970) who has asserted that, while politicians attempt to form coalitions of minimum size (so that spoils do not have to be shared too widely), organisation actors should attempt to make their coalitions as wide as possible (so that most resistance can be worked through).

Cooptation (one means of forming a coalition) has been identified by many researchers as an important tactic in neutralising resistance. Through cooptation, a potential resistor can be exposed to different attitudes and information, can be seduced by rewards and can provide a conduit into the organisation for the dissemination of information (Pfeffer, 1981). A particular form of cooptation is the involvement of end-users in information systems development work and, as observed by Leonard-Barton (1988), this has very nearly achieved the status of a principle. However, this is not always desirable.

First, as noted by Markus (1983), end-user participation is not advisable where powerful authorities have decided that a particular system, unpopular with users, *will* be implemented. Second, cooptation should be avoided if secrecy is important (Pfeffer, 1981). Finally, when implementation complexity is high, user involvement can have "the effect of intensifying and highlighting the potential conflict and disruption associated with an innovation" (Tornatzky et al., 1980). Leonard-Barton (1988) suggests that, in this case, a proper level of user involvement probably includes representation of key perspectives but, not necessarily, many people.

The above discussion on cooptation is focused largely on the dissemination and withholding of information. In 2.3.1 it was noted that organisation parties may resist systems integration initiatives with claims that their information is proprietary. However, information can also be employed as a bargaining tool. An excellent example comes from a case study involving a hospital administration's efforts to implement an integrated hospital information system (Kim and Michelman, 1990). In this instance, substantial resistance from hospital physicians was encountered and was successfully

addressed by focusing on the much-improved patient care information the system would provide the physicians.

The preceding discussion provides only a brief overview of tactical considerations that SISP implementors need address. For more comprehensive treatments (encompassing external coalitions, use of outside experts, establishment of symbolic positions, education, controlling the agenda and other tactics), the reader is referred to Pfeffer (1981 and 1992) and Lindner (1989).

## 2.4 RELATED WORK: AUTOMATED MODELS OF DECISION MAKING

A major distinguishing feature of MP/L1 is that artificial intelligence technology is used to represent and implement elements of a major theory of organisational behaviour. When implemented as an advisory expert system, the model can be employed by strategy implementors to predict and explain resistance resulting from power source redistributions.

Expert systems technology has, of course, been applied effectively to many areas of organisational decision making: for example, to financial planning, manufacturing control and fault diagnosis and prevention (Chandrasekaran, 1991). All these Decision Support Systems (DSS), however, are implementations of rational-choice decision making models - even where "fuzzy reasoning" (Negotia, 1985) is employed.

Recently, there has been much interest in Group Decision Support Systems (GDSS) (Watson and Bostrom, 1991), where information technology is used to reduce politics, with the aim of ensuring that group decisions have as sound a rational basis as possible. However, as has been argued by Fox (1991), current GDSS are "representationally weak", in that they do not allow the explicit representation of the underlying decision making theories.

GDSS are a sub-class of systems designed for Computer-Supported Collaborative Work (CSCW) (Grudin, 1991). Many benefits have been claimed for CSCW systems, with most emphasis being placed on their potential to improve cooperation between work units and individuals. Kling (1991), however, has argued that these benefits have been greatly overstated because political realities have been ignored. Specifically, he has argued that concepts with strong positive connotations (such as cooperation, collaboration and commitment) have been emphasised, without due attention being given to concepts with more negative organisational connotations (such as conflict, combat, competition and coercion).

Nevertheless, political concepts have been included in some DSS designed to support major organisational change initiatives. One example is the "Organizational Audit and Analysis Technology" developed by Mackenzie (1986) who employs a computer system to build up a data base of an organisation's positions, personnel, resources, processes and relationships between all of these. The basic premise of his model is that, in response to factors such as rapid environmental or technological change, organisations adapt by creating what he calls "virtual positions". Virtual positions involve three or more people, from different parts of an organisation, working together on recurring (and necessary) processes that have yet to be integrated into the formal organisation structure. Because virtual positions evolve as a result of organisational vulnerabilities and, because the actors involved are generally heavily dependent on each other, virtual positions are seen as arenas for power struggles.

Mackenzie views power as a situation rather than a variable and the extensional component of any of his data bases (the complete set of data base records) can be analysed to determine power sources derived from dependencies. His intensional data base component (the data base model), however, contains little of the semantics of his underlying model of organisation power. Nevertheless, Mackenzie has developed a useful automated aid that, while primarily intended for the task of organisational redesign, could be adapted for information systems strategy implementation. Furthermore, his concept of process hierarchies and linkages is fundamental to the MP/L1 model presented here.

Mackenzie's approach has its origins in the field of network analysis (Wigand, 1988) which is concerned with procedures and methods for analysing communication networks in large organisations. The goals of network analysis are to detect and specify communication structures at different levels (for example, at the individual, formal group, informal group and corporate-wide levels). Organisation networks, when identified and specified, can then be used to assess the effectiveness of various aspects of organisation life (such as the organisation's formal structure and its communication channels).

Computer systems have long been used to support network analysis. As early as 1963, Borgatta and Stolz (1963) computerised a clustering algorithm that allowed significant groups and cliques to be identified. Network analysis systems in common use, identified by Wigand (1988)[3], include GALILEO (Woelfel and Danes, 1980), MAPCLUS (Arabie and Carroll, 1980) and NEGOPY (Richards, 1975).

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[3] Note that Wigand classifies clustering/dimensional scaling systems within the the broad network analysis systems category.

Mention has already been made of how network analysis can be used to assist in the identification of appropriate parties when developing a model of organisational power. In addition, network analysis could usefully be employed to describe and analyse other power model concepts. Examples that come readily to mind are coalitions, power sources derived from consensus and dependency networks (c.f. Mackenzie, 1986).

Network analysis systems typically employ matrices, graph-theoretic representations, factor analysis and cluster analysis to represent and investigate network relationships (Knoke and Kuklinski, 1982). Wigand (1988) has stressed the importance of constraints in network analysis work. The principal knowledge representation formalism used in MP/L1, logic, is particularly well-suited to constraint representation (see, for example, the "Constraint Logic Programming" scheme of Jaffar and Michaylov, 1987) and this suggests that logic programming could well be used to advantage in network analysis. A work of particular relevance here is (Deliyanni and Kowalski, 1979), where it is demonstrated that semantic networks (Fikes and Hendrix, 1977) can be transformed to semantically equivalent logic representations. In MP/L1, logic is employed as a unifying formalism and implementation vehicle for power model concepts represented in network and entity-relationship (Chen, 1976) forms.

## 2.5 DATA-CENTRED INFORMATION MANAGEMENT

> Building a database is a political move;
> sometimes it is equivalent to a
> declaration of war.
> Waema and Walsham (1990: p.33)

In presenting the hypotheses for this research (see 4.3), a number of constraints are placed on the strategy implementation domain. The second of these specifies that the target environment must be a data-centred information management environment (DCIME). In a DCIME, all systems access a single set of data bases, with schemas conforming to a single Corporate Data Model (CDM). Ideally, the single set of data bases should be non-redundant. In practice, data clusters are often replicated or partitioned (because of cost, performance and security demands).

This constraint was specified: first, to limit the research scope to manageable proportions; second, because implementation of a DCIME is a strategic objective of many medium to large organisations; and, third, because the DCIME implementation success rate is very poor. Indeed, in a recent survey of 22 large Australian organisations,

Doll Martin Associates (1990) found that all had previously attempted to implement DCIMEs and all had failed. Technical and economic factors were proposed as the major cause of the failures but eight respondents nominated political factors as a contributing cause. Nevertheless, most organisations believed that a DCIME represented the *only* solution to their systems problems and 16 of the 20 were renewing their DCIME implementation efforts.

A recent report in the computer press (Soat, 1991) is instructive of the difficulties that DCIME implementors are likely to face. In an issues survey of 142 North American systems development directors, "Developing an information architecture" (an essential prerequisite for a DCIME) dropped from first place in 1990 to fourth place in 1991. A spokesman for the consultancy firm that conducted the survey was encouraged by this and saw it as evidence that information systems personnel were beginning to concentrate more on supporting business needs than on technical issues. This, of course, ignores the important role that an appropriate information architecture plays in defining business needs and in increasing development productivity (Martin, 1982). More importantly though, it is evidence of a fairly common reluctance to invest heavily in the development of an information infrastructure in return for major longer-term benefits.

The obstacles to realizing a DCIME have also been recognized by Kim and Michelman (1990). To gain competitive advantage from information systems, they propose a sequential 3-stage approach, consisting of breaking down political barriers, integrating transaction processing systems and, only then, using the integrated systems environment. to gain desired strategic advantage. They report on case studies where strategic objectives have not been met because of a failure to adequately address political and integration issues.

Markus (1983), Markus and Bjorn-Andersen (1987), Sager (1988b), Weill (1990) and Waema and Walsham (1990) are among others to have addressed political obstacles to information systems integration. Thus, there is considerable evidence that politics has played a significant part in many DCIME implementation failures. The researcher shares this view, but is also of the opinion that fundamental technical and management problems, associated with DCIMEs, have not been addressed adequately (either in the information systems literature or by practitioners).

This opinion is based largely on the researcher's experience and, in particular, his experience with the case study detailed in Chapter 5 (where significant technical and management problems were encountered with managing CDM evolution, ensuring compliance between the CDM and project data models and managing maintenance and

enhancements). In addition, technical, management and economic factors were, at least, partly responsible for Westpac's recent decision to abandon its ambitious CS90 DCIME development (BRW, 1991). Consequently, in this research, considerable emphasis is placed on examining resistance from both political and rational choice perspectives (see 2.3.2, 4.4.2, 5.8 and 6.8).

## 2.6 SUMMARY

There is considerable evidence that the SISP implementation success rate has not been good (Lederer and Sethi, 1988; Weill, 1989; Weill and Olson, 1989; and Doll Martin Associates, 1990). Furthermore, many researchers (for example, Kling, 1980; Markus, 1983; Leonard-Barton, 1989; and Lindner, 1989) have pointed to resistance from key organisational actors (rather than technical or economic factors) as a major threat to successful strategy implementation.

New information systems must not only satisfy economic and technical criteria for success but be politically feasible as well. Much political activity is concerned with the development and protection of power and new information systems change existing sources of power. Pfeffer (1981: p.7) defines *power* as "a force, a store of potential influence through which events can be affected", while *politics* "involves those activities or behaviours through which power is developed and used within organizational settings". He describes power as "a property of the system at rest" and politics as "the study of power in action". Pfeffer's stores of influence are *power sources*. Many organisation decisions may result in a redistribution of power sources, in which case there will be winners and losers and losers may *resist* change.

The case for the power model has been put forward by many eminent researchers in organisation studies; including Galbraith (1972), Kling (1980), Pfeffer (1981 and 1992), Markus (1983) and Frost (1987). In common with Pfeffer (1981) and Markus (1983), the view is taken here that resistance is neither good nor bad and that, in uncertain situations, resistance may well be the result of reasonable concerns rather than self-interest. Thus, all resistance should be examined from both power-political and rational choice perspectives. That is, much resistance will result from threats to power sources but it is also possible that the strategy has flaws and can be improved upon.

Predicting resistance though, is not a trivial task, in that useful results depend not only on nominating potential resistors but also on specifying the reasons for (or types of) resistance (Kotter and Schlesinger, 1979: p.107). In the MP/L1 model presented in Chapter 3, these linkages are represented, as well as relationships between power

sources. Thus, for any change initiative, the model will predict not only the more obvious areas of potential resistance, but also consequential resistance. This is important because many organisation actors will jealously guard some power sources, yet be relatively unconcerned about others (Pfeffer, 1981). Knowledge of sources of consequential resistance is essential if a change agent is to choose appropriate tactics.

Organisation "traditions" (Provan, 1989) play an important role in many models of power. One particularly useful approach is that of Frost (1987) who proposed a two-level power structure, where habits, traditions and dominant views, described as "systems of influence", are a source of *deep structure* power; a power source derived not from *surface level* dependencies between organisation actors, but from sociohistoric processes within the organisation. Frequently, systems of influence work to perpetuate an unequal distribution of power (when assessed at the surface level). Pfeffer (1981) has noted that organisation "norms" make the exercise of power expected and accepted and, effectively, identifies authority (institutionalised power) as a specific system of influence. MP/L1 employs the two-tier structure proposed by Frost and shows deep structure power being exercised through the manipulation of organisational rules that represent dominant beliefs and values.

A major distinguishing feature of MP/L1 is that artificial intelligence technology is used to represent and implement elements of a major theory of organisational behaviour. While expert systems technology has been effectively applied to many areas of organisational decision making (Chandrasekan, 1991), these applications have involved implementations of rational choice decision making models. MP/L1 has most in common with GDSS (Watson and Bostrom, 1991) but is distinguished from these systems in that its underlying knowledge representation paradigm (logic) is representationally strong.

Finally, this research is constrained to strategy implementations where the target environment is a DCIME (Sager, 1988b). This constraint was specified: first, to limit the research scope; second, because implementation of a DCIME is a strategic objective of many medium to large organisations; and, third, because the DCIME implementation success rate is very poor (Doll Martin Associates, 1990). The obstacles to realizing a DCIME have been recognized by Kim and Michelman (1990). To gain competitive advantage from information systems, they propose a sequential 3-stage approach, consisting of breaking down political barriers, integrating transaction processing systems and, only then, using the integrated systems environment to gain desired strategic advantage. They report on case studies where strategic objectives have not been met because of a failure to adequately address political and integration issues. Markus and

Bjorn-Andersen (1987) have observed that the integration of isolated systems, in particular, is a task fraught with political difficulties. Specifically, they note that because the integration task cuts across organisational boundaries, changes in work-flow, communication patterns and control processes may lead to a significant shift in the organisational balance of power.

# CHAPTER 3

## 3. MP/L1: A MODEL OF POWER IN FIRST-ORDER LOGIC

### 3.1 OVERVIEW

In this chapter, the model, MP/L1, is presented. The chapter builds upon the power model concepts presented in the previous chapter to produce a formal MP/L1 specification tailored to SISP implementation.

In 3.2, the rationale for employing multiple representation paradigms is presented. MP/L1 has been designed in a way that facilitates later expansion to domains other than information systems strategy implementation. This aspect is covered in 3.3, followed by the detailed specification of MP/L1 in 3.4. Finally, in 3.5, details of the automated, expert system, implementation of MP/L1 are presented. This section includes an analysis of the very important issue of semantic clarity versus run-time efficiency trade-offs.

### 3.2 REPRESENTATION FORMALISMS AND NOTATION FOR CONCEPTUAL MODELLING

Within the data management and artificial intelligence research communities, considerable attention has been focused on knowledge representation formalisms. Many extensions have been proposed to the dominant information modelling formalism, the Entity-Relationship (E-R) model (Chen, 1976). For relatively recent examples, the reader is referred to Teorey et al. (1986) and Maciaszek and Lucas (1987). In addition, NIAM (Nijssen's Information Analysis Method) (Verheijen and Van Bekkum, 1982), a conceptual modelling approach based on binary relationships, has gained acceptance in some quarters as an alternative to the E-R paradigm. Production rules (Hayes-Roth, 1985), frames (Minsky, 1975) and semantic networks (Fikes and Hendrix, 1977), while popular, are only three of many knowledge representation formalisms proposed for artificial intelligence applications.

Despite this proliferation of conceptual modelling approaches, there is a growing consensus that the approaches have much in common (Brodie et al., 1984). Reiter (1981) has gone further than this in claiming that logic, in itself a popular knowledge representation tool (Gensereth and Ginsberg, 1985), is the underlying formalism that unites all popular conceptual modelling approaches. Consistent with this, considerable research has been directed towards the logic representation of conceptual schemas

expressed in alternative formalisms (see, for example, Deliyanni and Kowalski, 1979; Reiter, 1984; McGrath, 1987; and Kifer and Lausen, 1989).
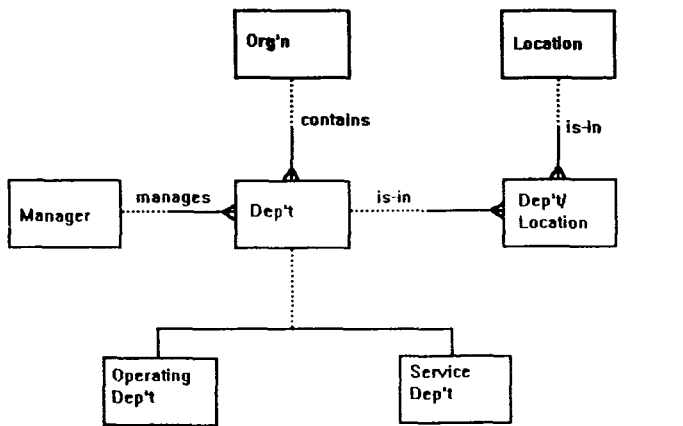
The practical usefulness of this is that the logic representation of a conceptual schema is both a declarative statement of a problem domain and computer code to a Prolog interpreter (Clocksin and Mellish, 1981). This is a direct consequence of the dual interpretations of logic as problem specifications and working programs (Kowalski, 1979).

At the same time, as argued by Israel and Brachman (1984), other representations often allow a clearer specification of some types of knowledge. Specifically, the view taken here is that elements of MP/L1 can best be expressed in network and E-R form. Thus, while logic is the underlying formalism and implementation vehicle for MP/L1, its specification will be represented using a combination of logic, network and E-R constructs. Specifically, the following formalisms are combined:

- a network represents the specific connections between power sources, functions and processes;
- an E-R structure provides the conceptual basis for MP/L1; and
- logic is employed as a unifying formalism, for the detailed description of the information systems strategy implementation domain and as the implementation vehicle for MP/L1.

For examples of the use of networks in describing aspects of organisational life, the reader is referred to Wigand (1988). The MP/L1 network is presented in Figure 3 and is described in 3.4.3.

Hawryszkiewykz (1984) and Kowalski (1979) provide detailed introductions to E-R modelling and logic programming respectively. The E-R model presented in Figure 1 is minimally sufficient for an understanding of MP/L1 and logic declarations presented in this thesis are either *facts* or *rules*.

**Legend**

A ------ B  each A must relate to a B and each B may relate to an A

——— represents a 1:1 relationship

——◀ represents a 1:m relationship
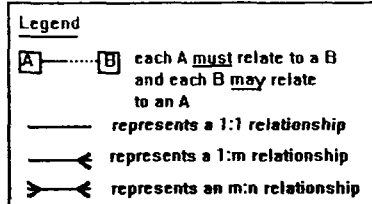
▶—◀ represents an m:n relationship

Figure 1: Example of an E-R Diagram.

An example of an MP/L1 fact is;

*currently-performs("IS Dept", "apps devlpt")*

which means that;

*the (party) IS Department currently performs (the process) applications development.*

An example of an MP/L1 rule is;

*has-a-power-source(x, control-over("critical function", y):-*
 *process(y),*
 *currently-performs(x, y),*
 *irreplaceable-in(x, y)*

which means that;

*(the party) x has a power source derived from control over the critical function*
*(process) y if*
 *x currently performs y and*
 *y is a process and*

*x is irreplaceable in y.*

It should be noted that the meaning of a predicate, such as *has-a-power-source,* is constrained by the need to keep the name succinct. Therefore, in some cases, meaning may not just be automatically translated from predicate and term names. Here, "derived from" is added from additional information about the problem domain not evident in the predicate name and terms.

The grammatical structure of each fact and rule corresponds to parts of the E-R structure in Figure 2. A fact corresponds to an entity instance or a relationship between entity instances. A rule corresponds to a (computer) procedure that operates over specific entities and relationships.

Suppose the following parts of Figure 2 are populated:

- entity instances of *Party, Process,* and *Enterprise Function;*
- the relationship instances of *Party Involvement* which have *Involvement Role, currently-performs* and *irreplaceable-in;* and
- the relationship instances of *Fn/Process* which have *Fn/Process Role, control-over*

then, the above rule can be invoked to determine which parties have power derived from control over critical functions (and vice versa). Note that all variables are local to the facts and rules in which they occur.

## 3.3 MP/L1: DOMAIN OF APPLICATION

While this research is focused on IS strategy implementation, MP/L1 has been designed more generally so that its domain of application extends to other areas where power theory applies.

The E-R structure of MP/L1 is presented in Figure 2 and key dependencies derived from the loops in the E-R structure are illustrated in Figure 2a. The structure is *generic* with respect to organisation power theory. It represents the inter-relationships and classification into entity types of relevant concepts of organisation power and politics.

Change Agent (Impl'tor)

Change Trigger [IS Strategy]

Implement'n Activity

Threat

Process

Change Agent Tactic

Involv'nt Role

Fn/Proc Role

Party

Party Involv't

Conflict

Personal Power

Fn/Proc.

Tactic

Likely Conflict

Unlikely Conflict

Enterprise Power

Enterprise Function

Rule

Applic'n Condition

Discount Factor

Surface Level Power Srce

Deep St. Power Srce

activity specific

company activity specific
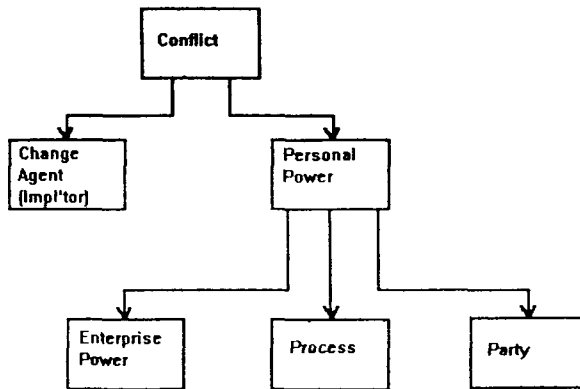
**Figure 2: MP/L1 Model - E-R form.**

Figure 2a: Key Dependencies Derived from the Loops in Figure 2.

The network of power sources and functions presented in Figure 3 is more specific. It shows particular links between particular concepts. The network was derived largely from concepts detailed in Pfeffer (1981) and Frost (1987). The upper levels of the network apply generically. They are as applicable to the organisation activities of resource allocation, performance appraisal etc. as to IS strategy implementation. The lower levels of the network (including the *process* to *critical function* links) are specific to a particular organisation activity. Thus, each network of power sources and organisation functions has a domain of application that is organisation *activity specific,* in this case IS strategy implementation. The particular links in the network are therefore between particular concepts, classified into the various entity types of Figure 2 and shown there as activity specific.

More specifically again, the organisation power model must involve the specification of company specific facts. The entities involved are shaded as *company activity specific* in Figure 2.

Thus, parts of the MP/L1 model can be referred to as generic, activity specific and company activity specific. These correspond to a hierarchy of application domain scopes. A particular instance of the MP/L1 model is therefore company activity specific and will be referred to as an *instance* model. This means, so far as the E-R structure in Figure 2 is concerned, that the three regions of the structure are populated respectively:

- by facts generic to organisation power;
- by facts that are activity specific; and
- by facts that are company activity specific.

Entity types within the activity specific region may be given an alias particular to the activity. These are shown in Figure 2 in brackets. When such aliases are used, the E-R structure may be referred to as an *activity specific domain E-R structure.*

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## 3.4 SPECIFICATION OF MP/L1

### 3.4.1 Specification Structure and Scope

Specification is a process of discovery where the concepts essential to a problem must be identified, related and represented. Here, discovery involves: 1) interpreting the work of the many scholars who have examined power model concepts; 2) synthesising these interpretations with the findings of the exploratory case study of a SISP implementation (presented in Chapter 5); and 3) structured representation of the results of this synthesis.

This specification of MP/L1 is organised around the E-R representation presented in Figure 2. Areas of the E-R model dealing with *Party, Enterprise Function* and *Process, Personal Power, Implementation Activity* and *Threat, Conflict* and *Tactic* are detailed in turn. The area of the model dealing with tactics has been included here for completeness and is discussed at a level of generalisation which does not deal with specific instances. Such generalisation of a concept allows convenient refinement in more specific detail at a later date.

### 3.4.2 Organisation Parties

An organisation *party* can be an individual, a position, an organisation unit (or sub-unit) or a coalition of these. A different set of parties will be involved in different activities in different organisations. Thus, *Party* has been shaded as company activity specific in Figure 2. Methods for identifying relevant parties were discussed in 2.3.3.

### 3.4.3 Enterprise Functions and Processes

The MP/L1 network of power sources and functions is presented in Figure 3. The network itself is shown on the left of the diagram and the E-R basis for the network is shown on the right.

INFLUENCE
(decision making)

Enterprise
Power

STRATEGIC
POSITION
(approval)

INFORMATION
(information
provision)

RESOURCES
(resource
provision)

RULE
(rule
manipulation)

BELIEF
(belief
manipulation)

AUTHORITY
(exercise
of auth'y)

EXPERT KN.
(knowledge
provision)

FUNDS SOURCE
(funds
generation)

VALUE
(value
manipulation)

ENTERPRISE CAPABILITY
(critical function)

Enterprise
Function

Fn/Proc.

Process:
-proc. arch development
 -proc. resource ownership
  -proc. resource allocation
  -proc. operations
-proc. provision
 -proc. arch. development
 -proc. maintenance
-rule application
-app's approval

-app's sponsorship
 -app's ownership
  -spec. mtce priorities
  -spec. db updates
  -approve db access
-app's development
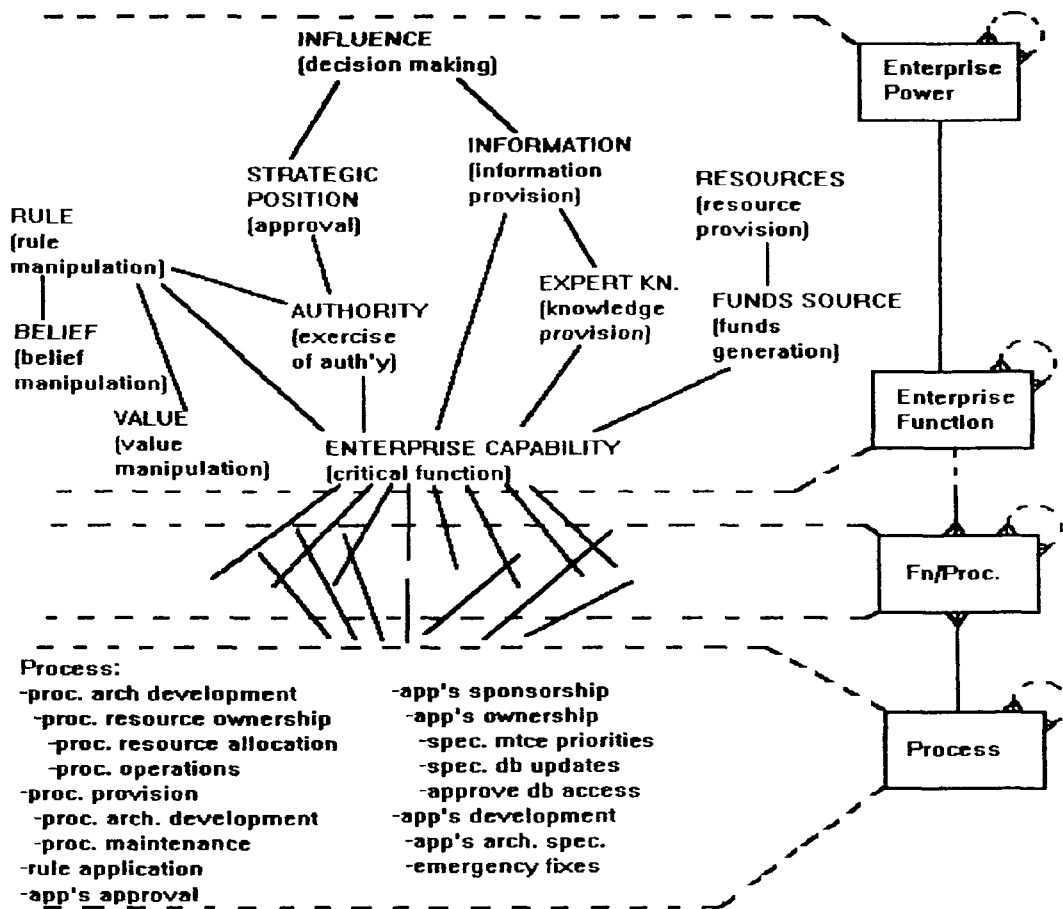-app's arch. spec.
-emergency fixes

Process

Figure 3: MP/L1 Network of Power Sources and Functions.

Enterprise power sources are represented in capitals and enterprise functions in lower case letters. The E-R diagram shows that enterprise power sources are related to enterprise functions on a 1:1 basis. Within the network, enterprise functions are shown beneath their corresponding enterprise power sources in brackets. Thus, *EXPERT KNOWLEDGE* is a power source that can be exercised through the *knowledge provision* function. The source for this conceptual representation is Pfeffer (1981: p.7), who, as mentioned in Chapter 2, has described power as a property of the system at rest while politics is power in action. Action, in turn, is expressed through enterprise functions.

The E-R diagram indicates that enterprise power sources are related to each other as are enterprise functions. Note that the representation of function-function relationships is technically redundant since these can be derived from power source relationships. As will become apparent, however, it is the function-function relationships that are of more interest in power source redistribution analysis. Each line in the network connecting two nodes represents an instance of a relationship between power sources (and the corresponding function-function relationship). Network links are specified in detail below but, briefly, they are used to represent a hierarchy of power sources and their

associated functions. For example, an organisation party may have an impact on *decision making* through involvement in either *approval* or *information provision* functions.

Enterprise functions are generic in that they are neither activity specific nor company activity specific. *Critical function* is a generic term which is applied to the set of activity specific processes which are judged to be critically important to the business activity under consideration (in this case IS strategy implementation). Ultimately, organisation parties must have some measure of control over activity specific processes that are critical in order to exercise power (Pfeffer, 1981: p.5). The set of processes judged to be critical for IS strategy implementation is shown at the bottom of Figure 3 and the power source corresponding to control over a critical function has been given the name *ENTERPRISE CAPABILITY.*

Each process shown is linked to *critical function* (with the *Fn/Process Role, control-over)* and processes may be directly linked to enterprise functions. The E-R basis for these links is represented by the *Fn/Process* intersecting entity and the links are represented in the network by the non-specific connections between the upper and lower portions of the network. The complete set of links is presented in Appendix 1.

Thus, to recapitulate, *ENTERPRISE CAPABILITY* is an enterprise power source (along with *INFLUENCE, INFORMATION,* etc.) that is exercised through control over a critical function. *Critical function* is a generic term designating a set of processes that are crucial to the utilisation of power within an activity specific domain (such as SISP implementation). Clearly, not all processes will be critical within an activity, a process may be critical within a number of activities and a process may be critical within one activity but not others.

The critical functions, which underpin IS strategy implementation, were an output of the case study detailed in Chapter 5. A business function was judged to be critical if it met the criteria of workflow pervasiveness, immediacy, interdependence and centrality, listed by Lucas (1984) as essential prerequisites for functional power. Also, critical functions may be considered analagous to the "critical success factors" widely used within business strategy development (including SISP studies). That is, just as critical success factors have been defined as "those few critical areas where things must go right for the business to flourish" (Henderson et al., 1984), critical function involvement represents the key to the development and maintenance of personal power within organisations.

Before specifying function and process relationships in detail, two further points need to be made concerning critical functions and their relationships with enterprise functions.

First, the enterprise functions are more general concepts and a general concept must conceal some context by subsuming the detail (Dampney, 1990). For example, *EXPERT KNOWLEDGE* is an important power source but is only a source of personal power if an organisation party has control over knowledge provision on some operational process (such as *processor maintenance* or *applications development*). Thus, in the end the more general concept prevails but is less immediate in application and, therefore, in an enterprise less powerful in an immediate operational sense.

Second, a business function is "critical" simply because it is judged to be so and this does not imply that the function is critical over all time periods. For example, a processor provider (typically a vendor) may exercise considerable power because the vendor has a monopoly over the knowledge necessary to maintain its processors. If, however, a third party maintenance firm can be found to take over processor maintenance, then the vendor's knowledge monopoly is eliminated as a personal power source. Consequently, while the MP/L1 network links are precise (in the sense that they indicate definite links between enterprise power sources and their associated functions), personal power specifications must sometimes be qualified. These qualifications are included in the *has-a-power-source* specification presented in 3.4.4.

Enterprise functions are related to each other, as are processes. Also, some processes may be related to enterprise functions (in addition to their mandatory link to *critical function*). In the E-R structure, these three types of relationships are represented respectively by the involutions[1] on *Enterprise Function* and *Process* and by the intersection of these two entity types in the *Fn/Process* entity.

In logic, each relationship is represented as a link, with the general form;

*linked-to(x1(y1, z1), x2(y2, z2))*

where *x1* and *x2* are function/process roles *(Fn/Proc Role* in Figure 2), *y1* and *y2* are enterprise functions, *z1* and *z2* are processes and the first term represents the function or process closer to the top of the MP/L1 network (as represented in Figure 3). The complete set of these links for IS strategy implementation is presented in Appendix 1.

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[1] *Involution* is an Information Engineering term (Finkelstein, 1989). More accurately, perhaps, an involution should be called a *recursion* (because, for example, enterprise functions are specified in terms of other enterprise functions).

A *Fn/Process Role* qualifies the nature of function-process relationships and is a linguistic device used to ensure a clear declarative reading of logic rules. The allowable function/process roles are *control-over, involvement-in* and *impact-on.*

In function-function links, processes are represented as variables, to be instantiated with specific processes at run time. Examples (from Appendix 1) are;

*linked-to(impact-on("decision making", x), involvement-in(approval, x))*
and
*linked-to(control-over("resource provision", x), control-over("funds generation", x)).*

As noted above, each process is linked to the enterprise function *critical function* with the *Fn/Process Role, control-over.* Each activity specific process must be declared as a fact;

*process(x)*

where *x* is a process name and the unique subset of all terms;

*control-over("critical fn", x)*

which may be derived through invocation of the first rule presented in 3.4.4 represents the set of process links to *critical function.*

In addition some processes (through their link to *critical function*) are directly linked to enterprise functions. These links have the general form;

*linked-to(x(y, z), control-over("critical fn", z))*

where *x* is an involvement role, *y* is an enterprise function and *z* is instantiated with a process name. Examples from Appendix 1 are;

*linked-to(control-over("funds generation", "proc opns"),*
*control-over("critical fn", "proc opns"))*
and
*linked-to(control-over("kn provision", "apps devlpt"),*
*control-over("critical fn", "apps devlpt")).*

Finally, processes may be linked to other processes, these links being represented as;

*process-link(x, y)*

where $x$ represents the process closer to the top of the MP/L1 network and $y$ is a process at a lower level. Examples are;

*process-link("proc arch devlpt", "proc provision")*
and
*process-link(spec-db-updates-for(x), ownership-of-app(x)).*

Note that in the second example both terms are compound, with $x$ representing an application. The fact conveys the information that an application owner may specify data base updates for the application.

The rule;

*linked-to(control-over("critical fn", x), control-over("critical fn", y)):-*
*process-link(x, y)*

is used to derive a representation of process-process links that includes their involvement in *critical function* and is consistent with the form used for function-function links.

Links are discussed further in 3.4.6. In practical terms, their existence means that a strategy implementor need only specify that parties are involved in processes, and that an implementation activity will threaten a party's involvement in a process, at the lowest levels of the MP/L1 network[2]. The links allow consequential threats to be derived. For example, a threat to a party's involvement in processor provision may result in consequential threats to the party's involvement in processing architecture development, approval processes and decision making.

Because of substantial concept overlap, in any power source classification scheme derived from the literature, these overlaps must be identified, resolved and removed. There is a judgement required to remove overlap and, to this extent, the classification is arbitrary. For example, the power source "dependence" (Emerson, 1962) is such an all-encompassing concept, that it would be valid to represent it as subsuming all other power sources, functions and processes. A similar difficulty arises with "coping with uncertainty", frequently cited (for example, Bariff and Galbraith, 1978; and Markus,

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[2] A reference to a "higher" or "lower" level MP/L1 function refers to whether it is closer to the top or bottom of the MP/L1 network, as presented in Figure 3.

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1983) as the most important source of power in organisations. Pondy (1977) has argued that theories of power, such as resource dependency, uncertainty dependence and uncertainty coping, are all variants of each other. Similarly, examples of uncertainty coping quoted by Pfeffer (1981) all relate to more specific power sources (such as control over expert knowledge, funds generation and information provision). For this reason, it was decided that the more specific power sources would be represented in MP/L1 in preference to the more general concepts of "dependence" and "coping with uncertainty".

The strategy implementor must specify what parties are involved in what processes. These are company activity specific facts corresponding to the intersection of *Party, Involvement Role* and *Process* in *Party Involvement* in the E-R structure. An organisation party can be involved in many processes and each process can involve many organisation parties. Furthermore, a party can be involved in a process in many ways, each involvement being called an *Involvement Role*. Allowable involvement roles are *currently-performs, has-authority-over, irreplaceable-in* and *has-a-monopoly-of-knowledge-on*. In logic, a party's involvement in a process is specified as a fact;

*x(y, z)*

Where *x* is an involvement role, *y* is a party and *z* is a process. Example are;

*currently-performs("IS Dept", "apps devlpt")*
and
*has-authority-over(Divisions, "apps sponsorship").*

The discussion above is focused on *surface level power. Rules* must be applied for the exercise of *deep structure* power. A rule can be a "tradition" (Provan, 1989), a "habit" (Lindner, 1989), a "norm" or "value" (Pfeffer, 1981: pp. 298-304), a "dominant value" (Carnall, 1986) or a "system of influence" (Frost, 1987).

*Rule manipulation* is an enterprise function and different forms of manipulation are appropriate in different activity specific domains (Frost, 1987). The case study detailed in Chapter 5 revealed many instances of the application of organisational rules and *rule application* has thus been included in the set of activity specific processes for IS strategy implementation. Rules are company activity specific and are represented as logic facts;

*rule(x)*

where *x* represents an organisational rule. Examples are;

*rule("The IS Dept have done a poor job.")*
and
*rule("Divisions must have maximum autonomy.")*.

### 3.4.4 Power Sources

As noted previously, parties derive power through their involvement in enterprise functions and, ultimately, through their involvement in activity specific processes. This is represented in the E-R structure by the intersection of *Party Involvement* and *Fn/Process* in the *Personal Power* entity and, in logic, by the rule;

*has-a-power-source(x, control-over("critical fn", y)):-*
  *process(y),*
  *currently-performs(x, y),*
  *irreplaceable-in(x, y).*

Implicit in this rule is that all declared processes are critical functions, that *critical* implies that the function is important (to the goals and work of the organisation) and that organisation parties (other than *x*) are dependent on the function. Thus, the rule is analogous to a mathematical statement of the relationship between personal power and Pfeffer's preconditions for personal power; viz. *importance, dependence* and *non-substitutability* (Pfeffer, 1981: Ch's 3 and 4).

The above rule corresponds to *critical function* in Figure 3. In addition, there are rules for each other enterprise function in the MP/L1 network. These complete the *has-a-power-source* specification and are presented below.

*has-a-power-source(x, control-over("funds generation, y)):-*
  *has-a-power-source(x, control-over("critical fn", y)),*
  *linked-to(control-over("funds generation", y), control-over("critical fn", y))*

*has-a-power-source(x, control-over("resource provision", y)):-*
  *has-a-power-source(x, control-over("funds generation", y)).*

The above rules express the power theory concept that control over resource provision is one of the most important sources of organisation power (Pfeffer and Salancik, 1978) and that, of the various resource types (funds, prestige, rewards, sanctions etc.), funds are the most important (because they are readily convertible into other resources). The

significance of funds generation in IS strategy implementation depends, to a large extent, on whether chargeback or transfer pricing arrangements are in place (the studies detailed in Chapters 5 and 6 provide contrasting examples).

Information too is a resource and a substantial body of recent literature is concerned with the conversion of information resources into profit and related resource types (see, for example, Broadbent, 1990; and Barrett, 1986-87). Nevertheless, information is such an important source of organisational power (see 2.3.1) that it warrants separate treatment in any power source distribution model.

In the MP/L1 network, *information provision* is shown at a higher, more superficial, level than *knowledge provision,* which is an enterprise function concerned with the provision of *EXPERT KNOWLEDGE* (a power source). Pfeffer (1981: p.113) relates an example where plant maintenance engineers exercised considerable power because only they had the knowledge to maintain essential plant. This is common in information systems work, where many systems are poorly documented and expert knowledge is often not readily replaceable. Thus, power derived from knowledge is specified as;

*has-a-power-source(x, control-over("kn provision", y)):-*
*has-a-power-source(x, control-over("critical fn", y)),*
*linked-to(control-over("kn provision", y), control-over("critical fn", y)),*
*has-a-monopoly-of-knowledge-on(x, y)*

with activity specific links to the enterprise function *knowledge provision* being declared for *processing operations, processing architecture development, applications development, processor maintenance* and *specifying maintenance (programme) priorities.*

*Information provision* is concerned with the concepts of meta-knowlege and control over access to information discussed in 2.3.1. Hence, activity specific links to *information provision* are declared for the processes *specifying data base updates* and *approve data base access.* In addition, *information provision* is linked to *knowledge provision* in the MP/L1 network. This simply means that expert knowledge has been declared (implicitly) as an information subtype (along with data base contents and meta-knowledge). This avoids the necessity to make the fine (but often confusing and contradictory) distinctions between data, information and knowledge found in many artificial intelligence research reports (for an example of one classification scheme, see Debenham, 1988). Thus, the rules relating parties to power derived from information provision are;

*has-a-power-source(x, control-over("info provision", y)):-*
*has-a-power-source(x, control-over("kn provision", y))*

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and

> *has-a-power-source(x, control-over("info provision", y)):-*
> *has-a-power-source(x, control-over("critical fn", y)),*
> *linked-to(control-over("info provision", y), control-over("critical fn" y)).*

Referring again to Figure 3, parties may influence *decision making* through their involvement in *information provision* or (formal) *approval* functions (Pfeffer, 1981: Ch.5). Consequently;

> *has-a-power-source(x, impact-on("decision making", y)):-*
> *has-a-power-source(x, control-over("info provision", y))*

and

> *has-a-power-source(x, impact-on("decision making", y)):-*
> *has-a-power-source(x, involvement-in(approval, y)).*

Involvement in approval functions (for example, committees) results largely from authority over processes in which parties are involved (Frost, 1987) and this is expressed as the logic rule;

> *has-a-power-source(x, involvement-in(approval, y)):-*
> *has-a-power-source(x, control-over("critical fn", y)),*
> *has-authority-over(x, y).*

Finally, the rule;

> *has-a-power-source(x, control-over("rule manipulation", app-of-rule(y))):-*
> *has-a-power-source(x, control-over("critical fn", app-of-rule(y)))*

expresses the concept (discussed in 2.3.1) that deep structure power can be exercised through the application of organisational rules. *AUTHORITY* is a form of deep structure power (Frost, 1987) and can be represented as rules such as "the IS Dep't has the right to develop and set processing architecture directions". However, while the *RULE-AUTHORITY* concept link is shown in the MP/L1 network, the link has not been implemented since deep structure power sources derived from authority can be identified through the invocation of the *approval* rule above.

### 3.4.5 Implementation Activities and Threats

*Implementation Activity* and *Threat* are shaded in the E-R structure as company activity specific. Implementation activities are represented in logic as;

*is(x, y)*

where $x$ is an activity identifier and $y$ is an implementation activity description. Threats are represented by the intersection of *Implementation Activity* and *Party Involvement* in the *Threat* entity and have the logic form;

*threatens(x, y(z, z1))*

where $x$ is an activity identifier, $y$ is an involvement role, $z$ is a party and $z1$ is a process.

For example, a strategy implementation activity might be the specification of a standard processing architecture. The activity would then be represented as;

*is(Acty-i, "spec of standard proc arch").*

The activity poses a threat to all parties involved in developing their own processing architectures and to the party that previously had authority over processing architecture development. These threats are represented as;

*threatens(Acty-i, currently-performs(x, "proc arch devlpt"))*
and
*threatens(Acty-i, has-authority-over(x, "proc arch devlpt"))*

where $x$ signifies a party. It should be noted that *threatens* is a second-order logic assertion. This is discussed further in 3.5.

As noted in 3.4.3, the MP/L1 links mean that the strategy implementor need only specify that an implementation activity will threaten a party's involvement in a process at the lowest level of the MP/L1 network. Specifically, threats to *processing architecture development, processor provision, applications sponsorship, applications approval, applications development* and *rule application* need be declared.

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## 3.4.6 Conflict

A fundamental premise of the power model of organisation decision making is that, where a decision or activity has the capacity to alter the distribution of power, "losers" may resist (Markus, 1983).

In the E-R structure, conflict is represented by the intersection of the *Implementor (Change Agent), Threat* and *Personal Power* entities in the *Conflict* entity. Note that the assumption is made that only one party is responsible for strategy implementation and that all resistance is treated as conflict between resistors and the *Implementor.*

In logic, potential resistance (conflict) is specified as;

> *may-resist(x, y, z(z1, z2)):-*
> *threatens(y, u(x, z2)),*
> *has-a-power-source(x, z(z1, z2))*
> and
> *may-resist(x, y, z(z1, z2)):-*
> *linked-to(z(z1, z2)), u(u1, u2)),*
> *may-resist(x, y, u(u1, u2)).*

The first rule is used to derive all potential resistance resulting from threats to a party's *(x)* power sources *(z(z1, z2))* resulting from an implementation activity *(y)*, at the lowest level of the MP/L1 network. This can be accomplished because the strategy implementor will have populated the *threatens* relation with the set of company activity specific threats (see 3.4.5). When implemented, a Prolog interpreter will repeatedly invoke the second rule (which, in turn, invokes the first rule) to derive all consequential conflict, based on the links, presented in Appendix 1, and specified in 3.4.3.

At any point in the process the strategy implementor, when presented with an instance of potential conflict, has the option to reject the instance as *unlikely* (see 3.4.7). If this occurs, the interpreter will discontinue its search along the network route it is following and try an alternate route. When all possibilities are exhausted, the process will be repeated for the remaining organisation parties.

As a result, MP/L1, when asked to identify all threats arising from a strategy implementation activity, will return, for each party, the list of all power sources (within the MP/L1 network) that may be threatened. Kotter and Schlesinger (1979) and

Mackenzie (1986) have highlighted the importance of comprehensively analysing the potential impact of any proposed change. MP/L1 provides a mechanism that may alert the change agent to consequences that may not be intuitively obvious.

### 3.4.7 Tactics

MP/L1 will only predict potential conflict. Thus, in the E-R structure, *Conflict* is divided into two sub-types; *Likely Conflict* and *Unlikely Conflict*. Tactics need only be devised if potential conflict is assessed as likely.

Organisation parties may not be aware of threats to power sources. Alternatively, they may choose not to resist; for example, they may not be particularly concerned over the potential loss of a power source, they may take a wider corporate view or they may be involved in issue trade-offs (Vilojen, 1991). These are all called *discount factors.*

When MP/L1 identifies a conflict, the user is asked to nominate any discount factors that might apply. If no factors are nominated, the conflict is classified as likely. If desired, the user may call on an explanation facility. For example, if information on the "wider corporate view" is requested, the explanation facility will provide the user with detail on "strong culture" organisations (see 2.3.1). Ultimately, however, the user must exercise his or her judgement as to whether discount factors apply.

As noted previously, MP/L1 does not, at this stage, have a tactics component that can be used to advise on the selection of appropriate tactics to combat resistance. This area is beyond the scope of this research, but MP/L1 is currently being extended to encompass tactics and the very high-level design is captured in Figure 2.

The starting premises are that power is context-specific (Pfeffer, 1981) and the corollary that no tactic is applicable in all situations (Markus, 1983). Thus, one or more *application conditions* are associated with any tactic and choice of tactics will depend on the implementor and the conflict. This is indicated by the intersection of *Tactic, Likely Conflict* and *Implementor* entities in the *Change Agent Tactic* entity.

### 3.5 AUTOMATED IMPLEMENTATION OF MP/L1

MP/L1 has been implemented as an advisory expert system, on an IBM PC/AT compatible, in Prolog, within the expert system shell APES (LPA, 1987). It was employed in both the laboratory experiment and field test stages of this research. Performance in the field (see Chapter 6), with a knowledge base of approximately 100

rules, 300 facts and substantial recursive processing, proved to be satisfactory (with no response time exceeding 5 seconds and most within the range 1-2 seconds).

Kowalski (1979), in presenting his equation;

$Algorithm = Logic + Control$

has argued that performance can be improved by tuning both logic and control components. The principal means of tuning a logic program is to manipulate the order of procedures and procedure calls, based on the most commonly invoked update or query functions. MP/L1 has been tuned for maximum (query) efficiency in responding to calls to predict conflicts.

Tuning logic for efficiency raises more complex issues. Often, major gains can be realised through employing an alternate logic representation, but only at the cost of diminishing the clarity and structure of the original logic declarations. Clarity versus efiiciency considerations must be judged on an individual basis and, in MP/L1, an alternative internal logic representation was employed for efficiency reasons. Specifically, the *has-a-power-source* procedure was eliminated and its logic was subsumed in an expanded *may-resist* procedure. This eliminated many unnecessary procedure invocations but the efficiency gains were realised at the cost of the explicit representation of the conditions under which parties have power (see 3.4.4).

In logic programs there is no clear distinction between code and data structures (van Emden, 1977) and a program may be interpreted as a "virtual relational data base" (Debenham and McGrath, 1982). Thus, the specification presented in 3.4 and the tuned, alternative, specification discussed here are analogous to conceptual and internal models in an ISO 3-Schema Architecture representation (Verheijen and van Bekkum, 1982). As with the 3-Schema approach, MP/L1's conceptual model emphasises clarity and structure and the internal model is designed for efficiency.

In 3.4.5 it was noted that the specification of the *threatens* relation actually involved the use of second-order logic. Prolog, in its pure form, is an implementation of a first-order logic programming system and theoretical research has established that the pure Prolog logic programming implementation is sound (which means, essentially, that the inference mechanism will generate correct results) (Kowalski, 1979). In practice, real-world applications require second-order logic (for example, to allow for data base updates) and most current Prolog implementations allow relation entities to be manipulated as terms in higher-order rules and assertions. As with special control predicates (for example, *cut* and *fail*) the use of second-order logic can, in some circumstances, compromise soundness. This applies particularly to specifications of dynamic data base update

procedures (Kowalski, 1979). In MP/L1, however, soundness is not compromised because it can be easily established that an alternative (but more unwieldy) first-order representation of *threatens* is equivalent to the representation used in 3.4.5[3] .

Finally, practitioners exposed to early versions of MP/L1 reported that identification of some consequential conflicts seemed unnecessary and did not add to their understanding of resistance encountered. Consequently, the experiment and field test versions of MP/L1 employed an amended version of the network presented in Figure 3. In this version, some network nodes were eliminated and concepts corresponding to the eliminated nodes were subsumed into other nodes to which they were linked. For example, the processes, *applications architecture specification* and *emergency fixes* were subsumed into *applications development*. The comment, that control over development of an application implies the right to develop the application's architecture and to make emergency fixes for the application, was then included in the APES explanation facility. The amended network is implicit in the MP/L1 recording form presented in 4.1 of Appendix 2.

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[3] Briefly, in the alternative first-order representation, *threatens* is represented as a set of binary predicates and SL-resolution (van Emden, 1977) can be employed to establish that *threatens(x, y(z, z1))* is a logical implication of the conjunction of *isa(u, involvement), involvement-role(u, y), party(u, z), process(u, z1)* and *threatens(x, u)*.

# CHAPTER 4

## 4. RESEARCH DESIGN

### 4.1 OVERVIEW

In this chapter, the research design is presented. In 4.2, building on the philosophical framework presented in 1.3, the research strategy is outlined and justified. Detailed designs for the three research stages, the case study, the laboratory experiment and the field test, are then presented in 4.4, 4.5 and 4.6 respectively. Appendix 2 contains details of all material used in the laboratory experiment.

Before proceeding, some general comments concerning data analysis need to be made. In this chapter, the data analysis methods used in each of the three research stages are discussed in sections 4.4.3, 4.5.4 and 4.6.3. Thus, the presentation of data analysis methods follows the research chronology: the exploratory case study, followed by the laboratory experiment and, finally, the field test. Actual data analysis, however, is spread through the next three chapters as follows: 1) in Chapter 5, case study data is analysed; 2) some analysis of field test data is undertaken in Chapter 6; and 3) in Chapter 7, laboratory experiment results are presented and analysed, and a consolidated analysis of data collected during the three research stages is undertaken.

### 4.2 RESEARCH STRATEGY CONSIDERATIONS

The research design is illustrated in Figure 4. The broad rationale for selection of the 3-stage approach was presented in 1.3.2.

The initial impetus for this research came from a desire to gain a better understanding of why so much SISP implementation has been unsuccessful - particularly where the target environment is data-centred (see 2.2). An analysis of the literature revealed that the power model (Pfeffer, 1981) and, more specifically, the power source distribution model (Markus, 1983), showed considerable promise as a means of describing the SISP implementation domain and as a prescriptive aid to practitioners. Thus, application of power model concepts to SISP implementation seemed to represent a promising approach to pursuit of the broad research aim.
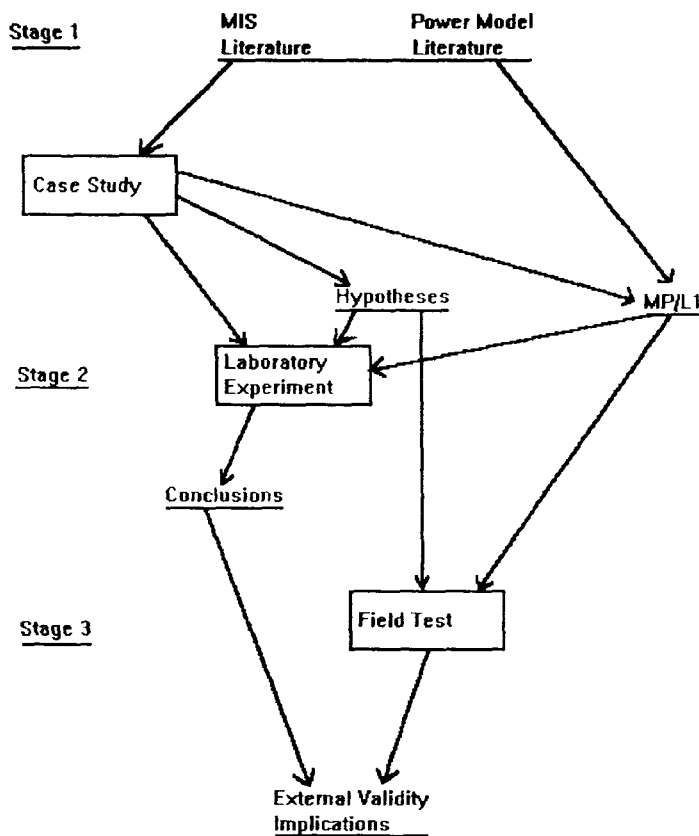
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Figure 4: Research Design.

The power model literature base was sufficiently rich to enable the development of an initial version of the power source distribution model, MP/L1. However, development of a detailed model required a thorough analysis of the SISP implementation domain. The exploratory nature of this task suggested that a case study approach would be appropriate (Benbasat et al., 1987).

The next phase of Stage 1 involved the development of site selection criteria. A common objective of many large organisations is systems integration through the establishment of a data-centred information management environment (Doll Martin, 1990). While the SISP implementation success rate, in general, has been poor (see 2.2), this applies particularly where a data-centred approach has been pursued (Sager, 1988b; and Doll Martin, 1990). A major contributing reason for this would appear to be that important technical and management principles underlying the data-centred approach are not yet known (see 2.5) and this leads to uncertainty which, in turn, means that many decisions will be based on power and political considerations (Pfeffer, 1981). In addition, implementation is complicated further where an organisation is heavily dependent on its information systems and where information systems responsibilities are disseminated widely throughout an organisation (Sullivan, 1985). Thus:

- pursuit of a data-centred approach;
- heavy organisation dependence on information systems; and
- wide dissemination of information systems responsibilities

constituted the Stage 1 case study site selection criteria. The selected site for the case study, "Gigante Corporation", met all these criteria.

The Gigante case study served as a platform for later research stages. Major outputs were:

- detailed data for input to MP/L1 development;
- a refined research question and specific research hypotheses; and
- a comprehensive data base for use in hypotheses testing.

In testing the hypotheses detailed in 4.3, the research variables were known and manipulation of independent variables was required. Specifically, conflict prediction depends on the party (individual or team) making predictions, the party's skill and knowledge, the time frame and the number of attempts, the prediction setting, the method employed and a number of extraneous variables. The requirement was to vary the method while controlling all other variables (discussed in 4.5). Guidelines on research strategy selection, presented by Benbasat et al. (1987) would therefore suggest that hypotheses testing should be based around the laboratory experiment or field test options.

A research strategy based entirely on a field test was rejected on practical grounds. Even if a sufficient number of cases of SISP implementations (conforming to the site selection criteria) could be found and participation arranged, variable manipulation in a natural setting would have been extremely difficult. (for example, it would not have been possible to ensure similar team composition across all implementations). Thus, the decision was made to first test the research hypotheses by means of a laboratory experiment.

The hazards of experimental-based research in the social sciences are recognised. Campbell and Stanley (1963), in tracing the history of experimentation in education, note that early enthusiasm gave way to widespread disillusionment and abandonment of experimentation in favour of non-scientific methods. Reasons given for this include initial grandiose claims for what experimentation would achieve, subsequent disappointment with early results and a reluctance to accept that, in most cases, there would be no one "crucial experiment" with a clear-cut outcome. In addition, an

acknowledged limitation of the scientific method is that the researcher can never prove a theory, only support it or falsify it (Popper, 1974). In the case of this research, controls imposed for internal validity reasons meant that experimental results could only be generalised with considerable caution (see 4.5.5).

Consequently, as the third stage of this research, it was considered necessary to test MP/L1, in the field, in a non-Gigante setting. It is recognised that this does not provide any conclusive statistical proof, but it does bolster the external validity argument more, for example, than retrospective application of MP/L1 to case studies drawn from the information systems literature.

In 1.3.2, the concept of the "critical case" (Yin, 1984) was introduced. A critical case may be used to test a well-formulated theory, which must specify a clear set of propositions as well as the circumstances in which they are believed to be true. In this research, the hypotheses and domain constraints presented in 4.3 represent the theory's propositions and constraining circumstances respectively. These were translated into a set of site selection criteria and applied in the selection of the second case study. The selected study involved implementation of a SISP at "South-Western University" (SWU) and, in Yin's terms, the second case study constituted a "literal replication" of the Gigante study.

Site selection criteria for the second case study are presented and justified in 4.6.1. It is important to note that the theory being tested implies that organisational factors outside the domain constraints should make no difference to the research results. Thus, one reason for the selection of the SWU site was that it differed from Gigante in a number of fundamental respects (such as nature of business, organisational maturity and geographical coverage).

## 4.3 RESEARCH HYPOTHESES, KEY TERM DEFINITIONS AND NULL HYPOTHESES

### 4.3.1 Research Hypotheses

Reference has previously been made to the poor SISP implementation success rate. The problem is significant because there is evidence that some organisations have invested many millions of dollars in development and implementation of their SISPs for little return (see, for example, BRW, 1991). Thus, the broad research question to be addressed was:

> Why has so much SISP implementation been unsuccessful and what can be done to improve the process?

A contributing cause would appear to be that most methodologies concentrate more on defining the target IS environment than on how the target environment can be implemented. For example, ACS (1988) contains the proceedings of a conference devoted entirely to SISP. Of the 16 papers in the proceedings, only one deals with implementation and then only in a superficial way (Dorahy, 1988, and his town planning analogy). Of particular concern is that little attention is paid to non-technical issues and this is a major weakness since, there is considerable evidence (see, for example, Kling, 1980; Markus, 1983; Leonard-Barton, 1988; and Lindner, 1989) to support the proposition that resistance from key organisational actors can represent a major threat to successful IS strategy implementation.

As argued in 2.3.2, it is imperative that SISP implementors factor the results of power source redistribution analysis into their consideration of encountered resistance. In Chapter 3, the power source distribution model, MP/L1, was described. MP/L1 describes power sources, their distribution, their relationships with organisation parties and processes and is capable of predicting power source distribution variations resulting from change triggers.

The detailed MP/L1 model was an output of the first stage of the research project, the Gigante case study. Also, a number of conclusions were drawn from the case study (see 1.2). These constituted the research premises from which the refined research question and detailed hypotheses were extracted. The refined research question is:

> Can a power source distribution model (specifically MP/L1) be used to assist information systems strategy implementors in predicting resistance?

and the research hypotheses are:

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In implementing information systems strategy:

H1: Strategy implementors do not predict
    potential resistance well.

H2: Exposing strategy implementors to the power
    source distribution model MP/L1 will improve
    their ability to predict resistance.

H3: Resistance prediction ability will improve
    further where implementors use the
    computerised (expert system) implementation
    of the power source distribution model MP/L1.
```

The Stage 1 case study site selection criteria (see 4.2) were translated into IS strategy implementation domain constraints. These are:

- Existing systems have their own data bases and data base custodians. Nominated parties are responsible for functional specifications (including data base updates), for setting maintenance and enhancement priorities and for approving requests for data base access. Many different parties are involved in these functions.

- The target environment is a data-centred information management environment (DCIME), in which all systems access a logically consistent set of data bases[1] . A single party is responsible for the specification and implementation of the lowest level of data base update code (adds, deletes, modifies and constraints). Further parties are responsible for establishment, maintenance and enforcement of both development and processing standards.

- The organisation has high levels of information systems infusion and diffusion. (Sullivan, 1985, has defined information systems diffusion as the extent to which information systems are disseminated in an organisation and information systems infusion as the importance, impact or significance of information systems to an organisation.)

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[1]  A DCIME is a logical concept and would rarely be implemented using a single, centralised, monolithic data base. In practice, for performance, security and cost reasons, data will often be partitioned, replicated and, perhaps, distributed.

In hypotheses testing, several null hypotheses are employed. Before presenting these, a number of key terms must be defined.

### 4.3.2 Definitions of Key Terms

The term, *MP/L1*, as used in the remainder of this chapter and in chapters 5-7 inclusive, refers to instance level customisations of the power source distribution model for the SISP implementation domain. When used within the context of the experiment, the term refers to the instance model for the Gigante SISP implementation. When used within the context of the field test, the term refers to the instance model for the implementation of the SWU SISP.

The term, *expert system*, refers to a computerised implementation of an MP/L1 instance model using the software identified in 3.5.

Other key term definitions are:

A *conflict* occurs where an organisation party (an organisation, organisation unit, individual or a group of individuals) resists a strategy implementor for a reason. Thus a conflict is a <party, reason> pair. In the case of the Gigante SISP, the strategy implementor is Corporate Information Strategy (CIS). In the case of the SWU SISP, the strategy implementor is the Administrative Information Systems Management Group (AISMG).

A *reason* for resistance is a threat to:

- a party's involvement in a process;
- a party's authority over a process; or
- the application of an organisational rule.

A *conflict string* is a list of connected nodes from the MP/L1 network presented in Figure 3 in 3.4.3, commencing with a process at the lowest level of the network and ending with a node at the top of the network. Effectively, a conflict string is a list of consequential reasons for resistance, resulting from perceived or real power shifts. Conflict strings employed in the experiment are presented in Section 5 of Appendix 3.

*Method A* involves experiment[2] subjects or strategy implementors predicting conflicts without being exposed to MP/L1 concepts (by the researcher, in either the experimental or field settings).

*Method A'* involves experiment subjects and strategy implementors predicting conflicts using the MP/L1 recording instrument (presented in Section 4.1 of Appendix 2) but without receiving detailed instruction on the use of MP/L1.

*Method B* involves experiment subjects and strategy implementors predicting conflicts after receiving the instructions (on using MP/L1) presented in Section 6 of Appendix 2 and using the MP/L1 recording instrument. That is, Method B is the application of MP/L1.

*Method C* involves experiment subjects and strategy implementors predicting conflicts using the expert system.

A *correct prediction score* is the percentage of correct predictions made by an experiment subject (in a test) or a strategy implementor (in the field). An *incorrect prediction score* is the percentage of incorrect predictions made by an experiment subject or a strategy implementor.

### 4.3.3 Null Hypotheses

The research null (sub) hypotheses are:

> H0a: Experimental group subjects are no more effective at conflict prediction than control group subjects when measured by correct prediction scores (when both groups use Method A).

> H0b: Experimental group subjects are no more effective at conflict prediction than control group subjects when measured by incorrect prediction scores (when both groups use Method A).

> H2a: Method B is no more effective than Method A' in predicting conflict when measured by correct prediction scores.

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[2]  "Experiment subjects" has been used in preference to "experimental subjects" when referring
to all subjects participating in the experiment because subjects were divided into experimental
and control groups.

**H2b:** Method B is no more effective than Method A $'$ in predicting conflict when measured by incorrect prediction scores.

**H3a:** Method C is no more effective than Method B in predicting conflict when measured by correct prediction scores.

**H3b:** Method C is no more effective than Method B in predicting conflict when measured by incorrect prediction scores.

Note that H0a and H0b are concerned with establishing group equivalence. Methods A, A $'$, B and C are discussed further in 4.5.3, under the heading "Data Collection and Instrumentation".

## 4.4 CASE STUDY

### 4.4.1 Case Study Aims

The role of the Gigante case study within the overall research strategy and design was discussed in 1.3.3 and 4.2.

Briefly, the study objective was to explore problems associated with SISP implementation in the field. While it was hoped that the study would produce some insights that might be of value to practitioners, its major purpose was as a platform for later, more focused, research stages. Specifically, the intention was to produce: 1) a refined research question; 2) specific hypotheses; 3) a "filled-out" version of the power source distribution model MP/L1; and 4) a data base for use in hypotheses testing.

### 4.4.2 Case Study Data Collection

The researcher was heavily involved in both the development and implementation of the Gigante information systems strategy. Employed by Gigante at the time, he was involved, first, as leader of the Technical Team during strategy development and, second, as part of the implementation team. Thus, the researcher was involved in action research.

As noted in 1.3.2, a danger of action research is observer bias. To guard against this, two other participants in the strategy implementation were asked to review the case study data base. A number of amendments were made as a result of this review process.

A strength of the case study design was the longitudinal data collection method employed. As noted by Franz and Robey (1984), events may be described in a more valid manner when data is collected as the events occur. For example, retrospecively, a party might attribute an act of resistance to a (subsequently proved) technical limitation when the resistance was in fact motivated by a potential loss of power. Thus, collecting data as events occur limits opportunities for retrospective rationalisation.

The data base on strategy development and implementation was built up from commencement of the SISP study (in August 1987) through to December 1990. The case study data base model is presented in Figure 5 and the data base listing is presented in Appendix 3.
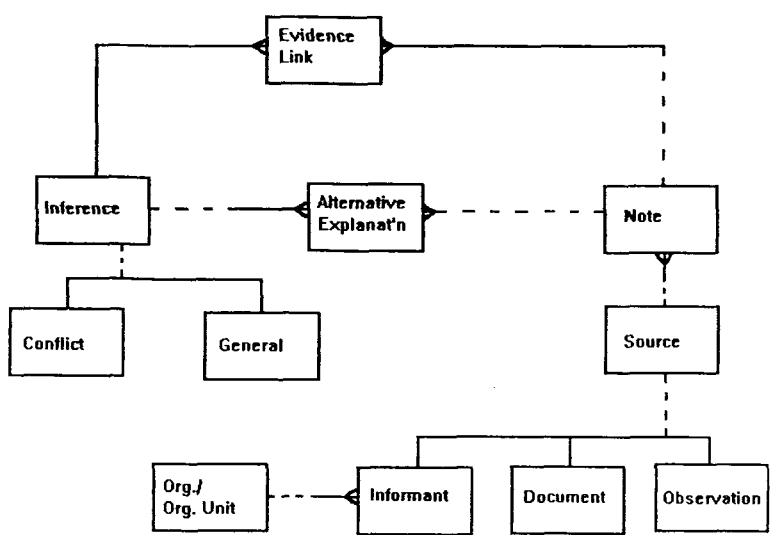


Figure 5: Telecom Case Study Data Base Model.

Data was collected from three source types. A *source* can be a *document*, an *informant* or an *observation*. Documents include working papers, interim and final reports and memos. Informants were parties that provided the researcher with verbal information (by telephone, in face-to-face conversations or in meetings). Observations were made of organisation parties and organisation events that were considered relevant to strategy implementation.

A *note* is a written account of information obtained from a source. The one source can (optionally) contribute to many notes.

An *inference* is a conclusion supported by evidence contained in the notes. Inferences are of two types, concerning either acts of *conflict* (generally, with the reason being inferred) or the more *general* conclusions presented in 5.6.3 of the case study report.

Notes are associated with inferences in two ways. An inference must be supported by at least one note (and possibly many) and the one note can (optionally) support one or many inferences. These associations are represented as *evidence links*. In addition, further analysis of an inference may result in one or more *alternative explanations*, which might be supported by additional notes. Section 4 of Appendix 3 contains details of inferences, alternative explanations and their links to notes.

While much data was collected originally in written form, the case study data base was maintained on a PC in a word processing document file.

The data collection procedures employed in the Gigante case study meet the three criteria listed by Yin (1984) as being essential: 1) the use of multiple sources; 2) the use of a data base with a classification scheme that allows easy update, retrieval and cross-referencing; and 3) maintenance of a chain of evidence.

With regard to the accuracy of the data collected, the researcher was in an excellent position to capture this data. As noted previously, he was part of the strategy implementation team. Also, while each team member had responsibility for specific projects, no one project was "stand-alone". Thus effective (informal) communication mechanisms were established to ensure that each member of the team was kept informed of the others' activities.

In addition, teams drawn from throughout the organisation were established to carry out each project. In general, members of these project teams were strongly committed to the strategy and wanted to see it succeed. As such, they provided an excellent conduit into the larger organisation and were often able to provide information that division managers would probably have preferred had been kept from the implementation team.

### 4.4.3 Case Study Data Analysis

Referring to Figure 5, inferences were made from notes from both power model and rational choice model perspectives.

The focus in data collection was on recording acts of conflict. "Conflict" and "reason" for conflict are defined in 4.2. Thus, each note concerning a conflict was analysed to determine if the conflict could conceivably be due to a threat to the resisting party's involvement in a process, authority over a process or application of an organisational rule. Further inferences were made regarding whether a threat to involvement in (or authority over) one process might result in a threat to another process or power source.

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Finally, each inference was re-examined from a rational choice perspective to determine other possible explanations.

The links established between inferences (relating to conflicts) were used in MP/L1 development; first, to develop conflict strings and then, by merging conflict strings, to produce the power source network presented in Figure 3 in 3.4.3. Processes identified as being under threat formed the "critical function" set of the MP/L1 SISP implementation activity specific model.

Those conflicts, identified as being relevant to that part of the SISP implementation that formed the basis of the laboratory experiment, were extracted from the case study data base and used to measure correct and incorrect prediction scores in experiment exercises.

A number of inferences were made that were not concerned directly with conflicts (classified as "general" in Figure 5). These inferences (also included in Section 4 of Appendix 3) were made from the case study notes and, in some cases, previous research findings (included in the literature base reviewed in Chapter 2).

## 4.5 LABORATORY EXPERIMENT

### 4.5.1 Selection of Subjects

In DCE (1989), advice on SISP team formation is provided. It is suggested that it is highly desirable to engage an experienced outside expert to lead (or contribute to) a SISP study. Apart from providing general information systems and management consultancy, the outside expert would be expected to play a major role in planning the study, advising on methodologies, tools and techniques and in "selling" the study results. In some cases the consultant would manage the study or, at the very least, would be expected to closely oversee the various study activities. The remainder of the team would be made up of staff drawn from within the organisation. These team members would typically be drawn from middle to upper management levels, have a good knowledge of the overall organisation and its personnel and an excellent knowledge of (at least) one functional area. They would be respected by senior management and have a good understanding of the way information systems are developed and used within the organisation. At least one team member would be drawn from the Information Systems Department. Thus, to summarise, a SISP team will generally be comprised of a consultant and an internal team. The consultant's role is to be expert in SISP and the

internal team's role is to contribute expert knowledge on the organisation and its information systems.

It was not considered practical to design and conduct an experiment using teams assembled as described above (mainly because of difficulties associated with finding sufficient, suitably qualified, senior managers prepared to play the role of functional experts). Instead, it was decided that the experimental sample would be drawn from the population of SISP consultants and that one experiment subject would constitute one SISP study team.

Specifically, experiment subjects were drawn from the population of SISP consultants operating in Sydney and Melbourne. The researcher's best estimate of this population is approximately 100. Of these, 40 were known to the researcher and, from this subset, 20 subjects were selected randomly and were assigned to experimental and control groups (again, randomly and with 10 subjects assigned to each group).

Intuitively, it does seem likely that a team (working with or without MP/L1) will predict conflict better than an individual. Also, in SISP work, conflict prediction would very rarely ever be a one-off exercise. A formal (or semi-formal) meeting may be the starting point, but initial results will almost certainly be modified as further intelligence is gathered. The experimental design does not allow the impact of these factors to be measured (a design accommodating these factors would have required more subjects than were available and a considerably greater commitment of subjects' time).

Variations in subject's inherent prediction skill, SISP experience, knowledge of organisation decision making and conflict and pre-knowledge of the experiment background material were controlled by:

- assigning subjects to experimental and control groups at random;
- presenting subjects with identical case study background material; and
- by using a pre-test to assess variations in prediction skill etc.

## 4.5.2 Test Administration

The broad experimental design is illustrated in Figure 6. The design was developed from a basic option presented by Isaac and Michael (1971).

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Subjects were first asked to familiarise themselves with background on the Gigante case study. In the pre-test both groups were requested to predict conflicts arising out of the SISP project, "APPS Development". Experimental group subjects were then introduced to MP/L1 and control group subjects to the post-test recording instrumentation. Subjects in both groups were then asked to take the post-test (again on APPS development). Control group subjects were then introduced to MP/L1 and experimental group subjects to the expert system. Both groups then repeated the post-test.

Test schedules are presented in Appendix 2. Note that the elapsed time for both groups was the same (4hr 50min).
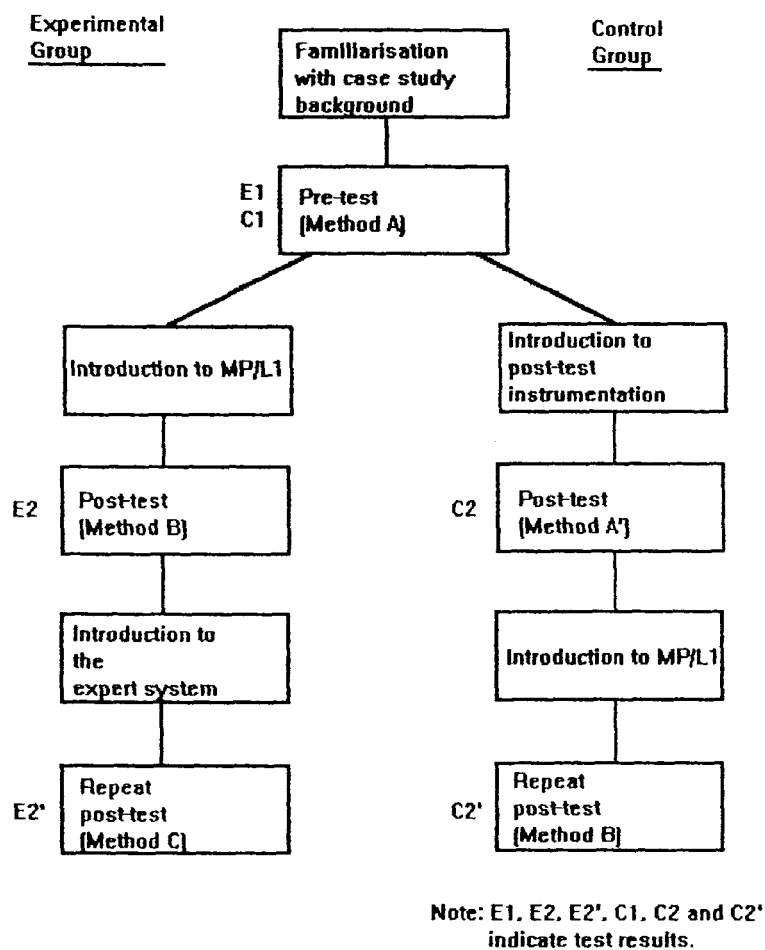


Note: E1, E2, E2', C1, C2 and C2' indicate test results.

Figure 6: Experiment Design.

The perils inherent in the experimentor conducting the experimental sessions were recognised. To minimise the possibility of experimentor contamination, all background information and instructions were conveyed to subjects in written form (see Appendix 2) and all responses were entered into a computer. The only verbal advice provided to subjects related to simple data entry procedure instructions.

The "laboratory" used in the laboratory experiment is a conceptual, rather than a physical, entity. Each test was conducted within a single day at the office of the subject. Tests were conducted in locations (offices, working party and conference rooms) that were isolated from the ongoing work of the organisation and no interruptions were allowed during testing periods. Only the researcher and subject were present during testing.

While locations differed, no test location was sufficiently poor that the dual aims of effectively isolating the subject during testing and ensuring that subjects were provided with a reasonably comfortable test setting were compromised. In any case, it is probably safe to assume that test setting differences would have evened out over the experimental and control groups.

Because the experiment was conducted in individual sessions (over a 2 month period), it was recognised that results could have been contaminated by subject interaction. To counter this, subjects were asked not to discuss the experiment until all sessions were completed. In addition, prior to each session, the subject was asked whether he or she had discussed the experiment with any previous participant. No subject acknowledged any interaction.

All material used in the experiment is presented in Appendix 2.

### 4.5.3 Data Collection and Instrumentation

All data was entered directly into a computer. All subjects used computers regularly in their everyday work and, apart from some text entry when using Method A, no method involved more than the use of simple cursor control, menu selection and return keys.

All data was entered into a computer. When using Method A, subjects entered reasons for conflict as text under party headings. When using Methods A' and B, subjects used the MP/L1 recording instrument (see 4.1 of Appendix 2) and this involved entering an "x" in a table cell, thus uniquely identifying a <party, reason> pair. When using Method C, subjects were asked to select (highlight) parties and reasons from menus. It was assumed that data entry processes with Methods A', B and C were equally efficient.

### 4.5.4 Data Analysis

The set of actual conflicts recorded during Gigante SISP implementation, relevant to the APPS project, is presented in Section 5 of Appendix 3. A prediction is correct when it

matches a cell in this table marked with a conflict identifier (c1-c67). Otherwise, it is incorrect. For definitions of correct and incorrect prediction scores, see 4.3. Experiment results are presented in 7.2.1 and supporting tables are presented in Appendix 5.

All null sub-hypotheses were tested using one-way ANOVA. t-values were calculated for correct and incorrect prediction scores for:

- E1 and C1 (to confirm group equivalence);
- E2 and C2 (to test H2a and H2b); and
- E2' and C2' (to test H3a and H3b).

Significance was set at the .05 level.

It should be noted that E2-C2 evaluation actually involves a comparison of subjects tutored in MP/L1 and subjects using the MP/L1 recording instrument. It was assumed that a significantly better performance by the experimental group in these circumstances would also occur where the control group used any preferred recording instrument. That is, a rejection of hypothesis H2a or H2b, combined with the above assumption, implies support for hypothesis H2.

To test H1 (i.e. that strategy implementors do not predict resistance well), the mean of all E1 and C1 correct prediction scores was calculated and compared with conflict prediction data extracted from the field test. Low correct prediction scores from both studies is assumed to provide support for H1. Similarly, H2 and H3 were subjected to "cross-experiment" evaluation.

### 4.5.5 Validity Considerations

From the foregoing discussion, it is contended that the experimental design effectively controlled:

- variations in subject's skill and knowledge;
- setting variations;
- instrumentation differences;
- pre-testing effects; and
- history, maturation, mortality and regression variables.

A number of threats to external validity, however, have already been noted. These are:

- equating one experiment subject with one SISP team;
- the non-iterative nature of the prediction processes;
- basing the experiment on a SISP implementation in only one organisation; and
- substituting background material for the contribution made by study team members drawn from within an organisation.

These factors were taken into account in hypothesis evaluation (see 7.3).

## 4.6 FIELD TEST

### 4.6.1 Site Selection

As discussed in 4.2, a field test of MP/L1 was considered necessary in order to provide support for the external validity argument.

To ensure that the second case study constituted a literal replication (Yin, 1984) of the Gigante study, the domain constraints specified in 4.3 had to be satisfied. Thus the selected site had to involve a SISP implementation where:

- the target information systems environment was data-centred;
- the organisation was heavily dependent on its information systems;
- information systems were widely disseminated throughout the organisation; and
- many parties from different parts of the organisation had important information systems roles and responsibilities.

Also, any test of the extent to which the earlier research findings can be generalised demands that the selected organisation should differ from Gigante in some fundamental respects. Common ways in which organisations are characterised (DCE, 1989) include the nature of their business, the extent to which the business is changing, organisation size, profit versus non-profit, public versus private ownership, maturity (age), structure, control strategies and mechanisms, geographical spread and history. There are, of course, many others but all of the above are fairly concrete (as opposed to, say, organisation culture and values) and have important information systems implications. Thus, it was decided that the selected organisation should differ from Gigante along, at least, some of these variables.

After investigating three other possibilities, implementation of a SISP at South-Western University (SWU) was selected as the subject for the second case study. SWU met the

four fundamental replication conditions listed above and differed from Gigante in the following respects:

- *Nature of business:* Teaching and research versus telecommunications.

- *Extent of change:* Medium versus high. Government and community pressures mean that universities are facing unprecedented demands, but it could be argued that the fundamental nature of their business is largely unchanged. On the other hand, rapid technological change is the catalyst for a worldwide revolution in telecommunications.

- *Non-profit versus profit:* SWU is facing pressures to pare costs, balance its budget and find additional sources of revenue. Gigante is increasingly being measured against its competitors in terms of its profit levels. In addition, its ability to generate substantial profits for reinvestment in new technology is critical to its survival.

- *Organisation size:* 1,200 people versus 80,000 people.

- *Maturity:* Two years old versus 16 years old (in their present forms).

- *Organisation structure:* A federated networked structure versus a divisionalised structure.

- *Geographical spread:* The outer-western regions of Sydney versus Australia-wide (plus some international operations).

- *History:* SWU was formed in 1989 through the amalgamation of three existing Colleges of Advanced Education. Gigante was formed in 1975 when the Postmaster General's Department was split into two government business enterprises (Australia Post being the other).

Detailed background on Gigante and SWU is presented in Chapters 5 and 6 respectively.

### 4.6.2 Field Test Data Collection

The field test data base conforms to the case study data base model displayed in Figure 5 and the field test data base listing is presented in Appendix 4.

As for the Gigante study, notes were made of information provided by sources and inferences were made from notes. Inferences, together with links to supporting and conflicting evidence, are presented in Section 4 of Appendix 4.

Data collection at SWU took considerably less time than at Gigante (4 months versus 3 years) and fewer sources were used. In addition, the activity was more focused, the emphasis being on collecting conflict-related data relevant to the strategy implementation project "Data Management".
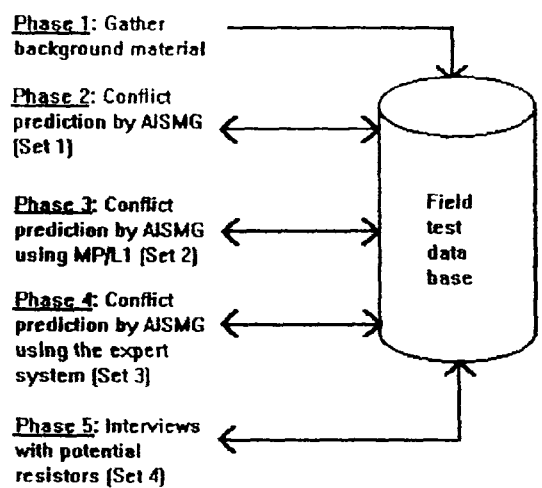


Figure 7: Field Test Data Collection Phases.

The field test data collection process is illustrated in Figure 7.

The first phase involved an information gathering exercise. The Administrative Information Systems Management Group (AISMG) was responsible for strategy implementation and a member of this group had prepared a paper on strategy preparation and endorsement (Kohlhoff, 1991). This paper was used as a primary source. In addition, strategy working papers and correspondence were reviewed and discussions were held with members of the AISMG and others involved in strategy development and implementation. A major output from Phase 1 was a matrix mapping organisation parties against their information systems roles and responsibilities. An initial version was prepared by the researcher and refined after review by the AISMG.

Phase 2 was undertaken in parallel with Phase 1. This involved the AISMG predicting resistance to the Data Management project. They were given two weeks to complete the task and were free to use any desired approach. Results were relayed to the researcher

who then translated their output into the set of potential conflicts, Set 1. Set 1 was revised after review by the AISMG.

Phase 3 was undertaken after the completion of Phase 2 and involved the AISMG predicting potential Data Management conflicts using MP/L1 and the recording instrument used in the laboratory experiment. The researcher led this exercise. An initial session was held, the researcher prepared a set of supporting notes and these and the completed conflicts matrix were sent to the AISMG for review. A further session was held in which the matrix was refined. The potential conflicts identified in this matrix constituted Set 2.

In Phase 4, the researcher prepared the MP/L1 instance model for SISP implementation at SWU and implemented it as the expert system. The AISMG then used the expert system to produce the conflicts set, Set 3. This was accomplished in a single session with the researcher providing guidance on use of the system. It should be noted that, in all prediction sessions, the AISMG reached their conclusions by consensus.

Finally, in Phase 5, interviews were held with identified resistors and from these the set of actual conflicts, Set 4 (presented in Section 5 of Appendix 4), was compiled.

As with the Gigante case study, the SWU field test data collection procedures satisfied the three essential criteria of use of multiple sources, use of a data base and maintenance of a chain of evidence (Yin, 1984). However, in comparison with the Gigante study, data was collected from fewer sources, was collected over a shorter time-frame and some data was collected retrospectively.

As noted by Avison (1990), there is considerably less opportunity in action research to control variables than in an experimental setting (once a site has been selected). Thus, to a large extent, the researcher was obliged to accept conditions as they existed at SWU. Also, to guard against other perils of action research, the researcher attempted to distance himself as much as possible from the AISMG in the critical conflict prediction sessions. Thus, his role in Phase 2 was limited to issuing initial instructions and collating results. The actual prediction sessions were held without his involvement. Similarly in Phase 4, while he was present at the prediction session, his role was limited to advising on use of the expert system. In Phase 3, however, the researcher was required to guide the implementation team in the application of MP/L1. Alternatives, such as training one team member to lead the prediction session, were not acceptable to the team (mainly because the team was concerned that researcher involvement was essential if the exercise was to yield best results from a practical viewpoint).

### 4.6.3 Field Test Data Analysis

Markus (1983) has proposed that organisational theories and models be evaluated according to:

- the *applicability* of the basic *assumptions;*
- the *accuracy of predictions* drawn from theories and models and
- the *usefulness of prescriptions* drawn from theories and models.

Field test data was analysed (and the research hypotheses evaluated) along the assumption applicability and prediction accuracy dimensions. Prescription usefulness is concerned with the development of tactics and, as noted earlier, is outside the scope of this research. Nevertheless, the researcher was involved in tactics development during the field test and this aspect is covered in the strategy implementation narrative.

Hypotheses evaluation along the assumption applicability dimension involved determination of the extent to which the domain description could be represented in MP/L1 (both manually and using the expert system). This evaluation was not quantitative. Instead, the evaluation focused on those domain description elements that did not lend themselves to convenient representation in MP/L1. Judgements were made of the significance of representation difficulties within the context of the total conflict prediction exercise.

Finally, quantitative evaluation measures were employed in assessing prediction accuracy. Set 4 was taken as the actual conflicts set and correct prediction scores were calculated for Sets 1, 2 and 3. Each of these scores was assessed against results obtained from the laboratory experiment.

# CHAPTER 5

## 5. CASE STUDY

## 5.1 INTRODUCTION

As noted previously, the Gigante case study served as a platform for later research stages. Specifically, its results were used:

- to refine the broad research question and generate detailed hypotheses;

- as input to MP/L1 development (particularly in relation to the identification of the critical functions discussed in 3.4.3); and

- as a data base for hypothesis testing.

The case study addresses the development and implementation of a SISP in Gigante Corporation. The SISP commenced in October 1987, following a wider organisation review, which recommended that Gigante's information systems were inadequate and should be redeveloped to meet future needs. The SISP study was completed within twelve months and its recommendations were endorsed by Gigante's Senior Management Council in September 1988. By this time, preliminary implementation activity had already commenced.

The researcher was employed on the SISP study as Technical Team Leader and on the implementation team as Manager Information Architecture. Data was collected from the commencement of the study through to December 1990 (when the researcher left the organisation). Data collection was concentrated on five key SISP projects. These were: Data Base Management System (DBMS) standardisation, the specification of a standard applications architecture, the specification of a corporate data model, the development of an "All Products provisioning System" (APPS) and the development of an "Integrated Management Information System" (IMIS). The focus in data collection was on resistance to the implementation of these projects and this aspect (covered in 5.5 and 5.6) forms the core of this case study discussion.

The case study was successful in that the three research objectives were met: namely, the research question and hypotheses were refined; MP/L1 was filled out substantially; and more than enough data was collected to enable the design of a realistic experiment. Results of the SISP implementation itself, however, were mixed. Certainly, some progress was made towards DBMS standardisation, a usable version of the corporate data model was developed and the standard applications architecture was specified. However, little was achieved in terms of "concrete" deliverables (i.e. new systems). Specifically, at the end of data collection, the future of the APPS project was under review and, while an early version of IMIS was in production, it was not being used to any great extent within the organisation.

In short, by end-1990, Gigante was still a long way short of its central strategic information systems aim of an integrated new generation of systems. In addition, Gigante has since merged with another public utility in the same business. In a recent interview, the newly-appointed CEO of the merged organisation stated that he intended to undertake a major review of its operations and indicated that he had strong negative views on the organisation's existing information systems (principally because of duplication in systems and data bases). It is possible that the current IS strategic direction may be substantially amended or, even, abandoned altogether. If this occurs, it would be similar to the Westpac experience, where, in 1991, their newly-appointed CEO closed down their very expensive and high-profile CS90 systems integration project (BRW, 1991).

The reader should bear in mind that it was not a principal objective of this case study to judge the merit of the Gigante SISP study (for example, to determine if it was technically or economically sound or if it was aligned with the needs of the business). Neither is any claim made that it was resistance from vested interests that was *solely* responsible for the lack of progress on strategy implementation, nor that the strategy would have been defeated by this resistance regardless of its specifics. As noted above, one purpose of this case study was to generate detailed research hypotheses. Much resistance was observed and recorded and it was concluded: first, that resistance was not predicted well; and, second, that much resistance encountered could have been explained, and was predictable using a power model framework. These conclusions were translated into the detailed research hypotheses presented in 4.3.

This thesis is concerned primarily with the issue of resistance prediction rather than with tactics that might be employed to counter resistance. Thus, analysis in this chapter is focused on explanations of resistance encountered during the case study. Nevertheless, judgements were made on the effectiveness of change management tactics employed

and these are presented, in 5.7, under the heading "Management of the SISP Change Process". While not central to the thesis, it was considered that these judgements should be recorded: first, because their inclusion results in a more complete account of the study; and, second, because the conclusions drawn are important input to further research (specifically, extending MP/L1 to encompass a tactics component).

The case study research design was presented in 4.4. Findings and facts included in this chapter are supported by material in the case study data base listing presented in Appendix 3. Citations enclosed in square brackets, [Dtx], [Ntx] and [Inx], refer respectively to supporting case study data base documents, notes and inferences. A number of acronyms are used in this report. The use of these was largely unavoidable and, to assist the reader, a glossary of acronyms is presented in Table 1. The table has been replicated on the lift-out card included inside the back cover.

### Systems

| | |
|---|---|
| APPS | All Products Provisioning System |
| CABS | Gigante's major billing system |
| CONDOR | Gigante's customer information system |
| DCRIS | Provisioning system for basic services |
| FAMIS | Gigante's suite of accounting packages |
| IMIS | Integrated Management Information System |
| PURCHASE | Gigante's supplier purchasing system |
| RASS | Provisioning system for special services |

### Parties

| | |
|---|---|
| CEO | Chief Executive Officer |
| CIO | Chief Information Officer |
| CIS | Corporate Information Strategy |
| CNSS | Customer National Support Systems |
| DMD | Deputy Managing Director |
| EGM | Executive General Manager |
| MD | Managing Director |
| GAIS | Gigante Australia Information Systems |

### Technology

| | |
|---|---|
| DBMS | Data Base Management System |
| DISNET | CNSS's District Network |
| GACONET | Gigante Australia Computer Network |
| GIME | Gigante's Information Management Environment |

Table 1: Glossary of Case Study Acronyms.

Finally, Figure 8 contains a time-line representation of the Gigante SISP development and implementation. Reference to this diagram may be of assistance when reading later sections of this chapter.
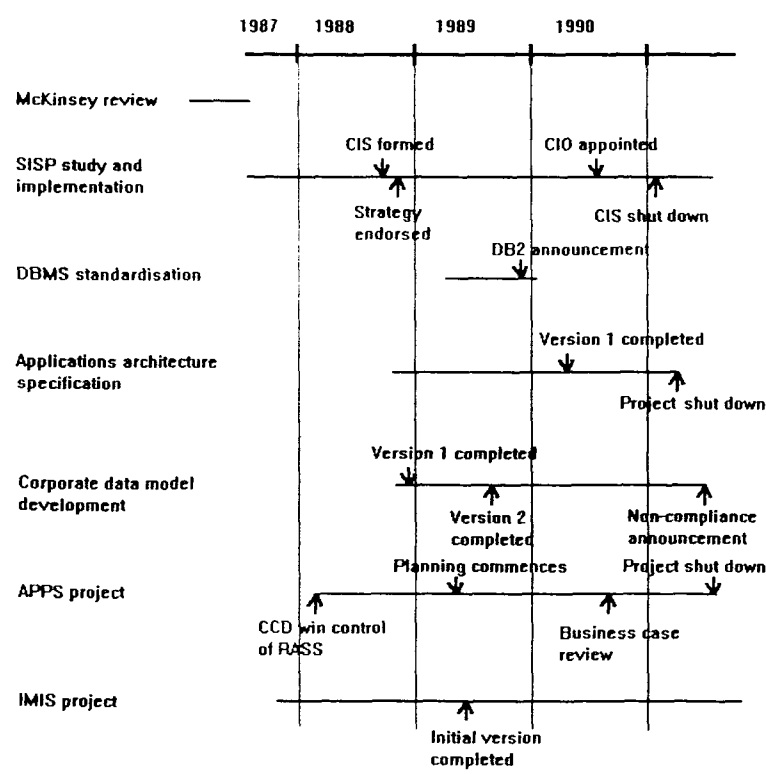


Figure 8: Gigante SISP - Significant Events.

## 5.2 GIGANTE: THE ORGANISATION

Gigante Australia is a public utility (100% Australian Government owned) whose primary function is providing technology-related goods and services to the Australian community.

Originally operating as a Public Service department, Gigante, since its inception, has had monopoly control over its specific area of activity in Australia. From the early 1980's, however, its monopoly had been severely diluted to a point where, from 1991, it faced competition in all sectors of its operations.

The first step in this process came when other companies were permitted to supply (but not install and maintain) some classes of customer equipment.

Next, in May 1988, the Government announced a number of major changes affecting Gigante. These included the following: further services were opened up to competition; a new independent body was established to take over Gigante's regulatory role; and Gigante was established as a corporation, with greater freedom in operations such as financial borrowings and staffing, but with a requirement that the organisation would have to pay the same taxes as its competitors.

In September 1990, following a lengthy review, the Government announced that Gigante would merge with another public utility in the same business and that the new organisation would be exposed to across-the-board competition through the licensing of a competitor. In July 1991, the merger took place and, in November 1991, a consortium was granted a license to compete with Gigante in the provision of its basic services. The consortium commenced operations in June 1992.

As these changes to the environment were occurring, in 1986, Gigante management, increasingly concerned about its ability to succeed in a competitive environment, commissioned the consulting firm McKinsey and Co. to review Gigante's organisation structure and operations.

The major outcome of the review was that the previous State and product-based structure was to be replaced by a "customer-focused" structure, comprised of four divisions (each responsible for a customer sector) and a number of shared resource units (each responsible for a particular area of functional support). The four customer divisions were Corporate Customer, Gigante Residential, Gigante Business Services and Country, and the shared resource units included Material Services, Accounting, Gigante Network Engineering and Gigante Australia Information Systems (GAIS).

Corporate Customer Division and GAIS, were established in July 1987 and the remainder of the organisation structure was put in place in May 1988. The Gigante organisation structure is presented in Figure 9.
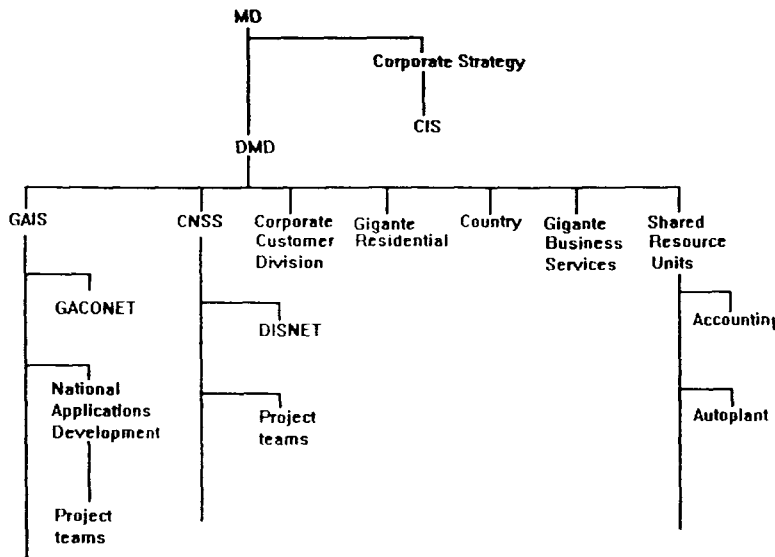
Figure 9: Gigante Organisation Structure (Oct.1988 - end 1990).

Other outcomes of the McKinsey review, relevant from an information systems viewpoint [Dt5], were that:

- Gigante's information systems were inadequate to meet the needs of the changing environment;

- divisions and shared resource units were to be given maximum autonomy;

- managers, to the lowest level possible, were to be accountable and were to be subject to performance-based pay; and

- shared resource units (including GAIS) were to be given a two year "period of grace", during which they would be sole provider of services; after that, they would be open to competition (in fact, GAIS, in particular, was already facing significant competition from alternative providers of information systems services - see 5.6.5).

The McKinsey review also recommended that a SISP study be undertaken to address the organisation's information systems problems. This (along with the other major McKinsey recommendations) was agreed to by senior Gigante management and the SISP study is discussed in 5.4. Before that, an overview of Gigante's IS environment, pre-SISP, is presented in the following section.

## 5.3 GIGANTE'S IS ENVIRONMENT: PRE-SISP

### 5.3.1 Gigante Australia Information Systems (GAIS)

The organisation unit in Gigante with primary authority over, and responsibility for, the information systems function was the Information Systems Department (GAIS). It had responsibility for computer operations and for the technical aspects of Gigante's systems development and maintenance activities.

GAIS's computer operations responsibilities included development and maintenance of the Gigante Computer Network (GACONET), GACONET Data Processing Centre operations, support for GACONET users and development of the GACONET processing architecture.

On the systems development side, GAIS was the primary provider of technical staff (analysts, designers and programmers) used on major systems project teams.

### 5.3.2 Gigante Australia Computer Network (GACONET)

The hubs of the GACONET network were mainframe installations, located in Sydney and Melbourne. Megalinks connected the mainframes to smaller centres in the remaining capital cities. Little processing was done in the remote centres, their primary purpose being to act as traffic concentrators. Gigante had a dual-supplier policy, the hardware vendors, Bull and Fujitsu, supplying Gigante with its mainframes.

While all major systems ran on GACONET, many other computers (minis and PCs) had been purchased and were in use throughout Gigante. Many local systems had been developed without GAIS involvement. While some of these systems received direct feeds from mainframe systems, the majority were reliant for their data on re-keying from hard-copy reports generated by the major systems running on GACONET.

Finally, from mid-1988 (following establishment of the new organisation), a sharp increase occurred in the use of non-GACONET UNIX-based mini-computers. Support for this processing environment was particularly strong in Customer National Support Systems (CNSS) and Country Division [Nt18, Nt26, Nt27, Nt29].

### 5.3.3 Systems

Historically, in Gigante, systems development had been user-driven. User divisions were responsible for initiating projects, for gaining project approvals and for ensuring that systems were developed, implemented and operated within budgets and deadlines. In

addition, users were responsible for forming project teams and for project management. Thus, typically, a project team had two components: a user team, responsible for overall project management, for much of the analysis work and for systems testing and implementation; and a GAIS team, responsible for planning and support during analysis, detailed systems design, coding and program testing. Each GAIS sub-team had its own project manager and, generally, resented any attempts by users to involve themselves in technical activities [In6].

Following implementation of a system, the GAIS team was required to provide technical support for the life of the system. The user team "owned" the system, meaning that they had control over the setting of maintenance/enhancement programme priorities, system data base access approvals and the specification of functionality for maintenance and enhancement items (including data base updates). CNSS owned nearly all the major systems.

Gigante's business operations were heavily integrated but its systems had all been developed on a functional area basis. Consequences of this included massive data redundancy and major data inconsistencies, duplication in systems development and a proliferation of 1:1 system-to-system interfaces [Dt5]. A significant duplicate development had occurred in the product orders area, where DCRIS (for "plain ordinary services") and RASS (for special products) had much the same functionality. The difficulty with direct system-to-system interfaces is that they have the potential to increase in geometric progression with the number of systems. *In Gigante, the problem was severe, with 630 separate interfaces and 43% of total GACONET capacity being devoted to interface processing.*

From the early 1980s, Gigante had increasingly turned to packages for its systems solutions. It is the researcher's opinion that a detailed investigation of this strategic move would not judge it to have been a success: over 90% of DCRIS code had to be customised; CABS and DCRIS customisation both demanded several hundred man-years of effort and CONDOR, PURCHASE and FAMIS implementations were all multi-million dollar projects. Nevertheless, during 1988-90, there were still many in Gigante who believed that their systems' problems could be solved quickly and inexpensively with a package solution [see, for example, Nt45].

### 5.3.4 System Approvals

Prior to the reorganisation, a senior management group had responsibility for approving any computer project or purchase in excess of $1M. This unit was chaired by the EGM

GAIS and was heavily dependent on an approvals unit within GAIS for advice. Following the reorganisation, the senior management group was disbanded and divisions only had to refer information systems proposals to the DMD if the total cost (including equipment purchases) was in excess of $6M. This increase in local IS cost delegations merely legitimised what had been happening in practice, where many user areas had purchased computer equipment under non-IS budget heads and had used "slack" resources to develop local projects [Nt7a].

### 5.3.5 Funding

GAIS had a chargeback system in place from 1977. They billed the system owners for development and operations costs and the owners passed on the bills to the end-users in the divisions.

Prior to the organisation review, GAIS bills were not taken very seriously in the larger organisation. After the review, however, the divisions realised that their information systems costs were one of their larger budget items and that, ultimately, they would be held accountable for these costs [Nt26]. This had an immediate impact on users, GAIS and the system owners; the users demanded more accurate and itemised bills, GAIS had to ensure that its charges were competitive and the system owners found that their control over end-users had diminished [Nt4, Nt30, Nt78]. A further major impact on system owners was that, in future, they would have to charge the divisions for their own costs. CNSS, who had not previously been obliged to recover their costs, were the unit most affected by this [In8, In9].

### 5.3.6 Other Involved Parties

Besides GAIS, many areas of Gigante were involved in information systems activities. Of these, the most significant were CNSS and the divisional IS units (formed as part of the establishment of the post-review divisions). CNSS and divisional information systems activity are discussed in 5.6.

### 5.4 GIGANTE SISP STUDY

As noted in 5.2, the SISP study was initiated in response to the McKinsey review observation that Gigante's information systems were inadequate for the organisation's future needs. The study was led by a senior executive (the EGM Shared Resource Units), Arthur Andersen and Co. provided consultancy, and ten middle to senior-level Gigante

managers and technical specialists were employed full time on the study. Work on the study commenced in August 1987 and was completed in October 1988.

The major study recommendations [from Dt5, Dt6 and Dt7] were as follows:

- Formal information management techniques should be employed to build an integrated new generation of major systems, within a data-centred information management environment to be called "Gigante's Information Management Environment" (GIME).

- Systems within GIME should be developed and processed on a standard processing architecture, the specification of which was to be guided by the principle that, for any one element of the architecture (for example, DBMSs), a minimum set of products was to be used.

- A GIME systems (or applications) architecture was to be specified. GIME systems would be required to conform to the applications architecture.

- A Corporate Information Strategy (CIS) unit, located in Corporate Centre and responsible for strategy implementation and its ongoing development (including processing and applications architecture standards), should be established.

- Divisions developing GIME applications would be assigned lead-house responsibility and would be required to take the needs of all divisions into account.

- Divisions undertaking developments would be expected to provide their own funding and to develop their applications within GIME. For any expenditure in excess of $6M, the DMD's approval had to be obtained and CIS was to be the judge of whether systems were GIME-compliant.

- Divisions with urgent short-term needs could develop non GIME-compliant systems but would be expected to prepare detailed plans for eventual redevelopment of their systems within GIME.

- All data was to be "owned" by CIS on behalf of Gigante. Thus, the concept of system data bases (and with it, system owners controlling their own data bases) would disappear.

- GAIS would contain a Gigante Information Centre, responsible (on behalf of CIS) for development of the corporate data model, the GIME processing and applications architectures and for a set of "atomic processes". The atomic processes would perform the adds, deletes and modifies of the data in the central set of data bases. All application data base access was to be accomplished by invoking atomic processes.

The strategy (including all recommendations detailed above) was endorsed by the DMD and division/shared resource unit heads in September 1988 [Nt22]. In anticipation of this, implementation activity had already commenced; the CIS unit had been established, its Director had been appointed and he was some way advanced in planning the initial implementation projects.

## 5.5 SISP IMPLEMENTATION PROJECTS

### 5.5.1 DBMS Standardisation

The SISP study had highlighted the fact that Gigante's major systems were built on a platform of 10 different DBMSs and that further DBMSs were installed on GACONET. In part, this was due to the fact that packaged systems were tightly coupled to a particular DBMS. Another factor was that project managers had been free to select whatever DBMS they considered most suitable for their applications. Consequences of the proliferation of DBMSs included: excessive software purchase and support costs; excessive staff training costs; systems interconnection difficulties; and, probably most importantly, difficulties in moving staff between projects.

The aim of the standardisation project was to identify a "minimum set" of DBMS products to be used for GIME applications development and processing. Selection criteria included product cost, performance, conformance to evolving international and de facto standards, viability of the product supplier, and the extent to which the product was in use within the information technology industry [Dt11].

The project commenced in May 1989, when CIS commissioned a consultancy firm to survey available products and make initial recommendations. The consultants reported in September 1989 and identified DB2, IDMS, TERADATA, ORACLE and INGRES as best meeting the selection criteria [Dt12]. CIS then asked the Gigante Information Centre to form a working party, with a brief to make a firm selection from the product short-list (as identified by the consultants) by November 1989.

The working party reported on schedule, their recommendation was accepted and, in December 1989, CIS announced to the organisation that DB2 would be used for all GIME mainframe development work [Dt13].

Had a distributed processing selection been made, ORACLE would have been the probable choice. CIS's motivation for not making a selection was a desire to develop and process the initial GIME applications centrally. Their belief was that distributed solutions would unnecessarily complicate an already technically-difficult task [Dt13].

### 5.5.2 Applications Architecture Specification

The starting point for the applications architecture project was a SISP study recommendation that GIME systems should be developed using a standard applications architecture, based on a number of important information engineering and software engineering principles. Before detailed specification of the architecture could commence, these principles had to be expanded into guidelines [Dt17]. This activity was undertaken by CIS and the guidelines were released to the organisation in August 1989, at which time the GM National Applications Development, GAIS, offered to establish a Development Support Centre and resource it to undertake specification and ongoing development of the architecture. His offer was accepted by CIS.

The Development Support Centre completed its specification of the initial version of the applications architecture [Dt14] in April 1990, whereupon the specification was distributed throughout the organisation for comment.

Following appointment of a Chief Information Officer (CIO) in July 1990, further work on the GIME applications architecture was abandoned (discussed further in 5.7.3). Gigante's recently developed "Overall Systems Architecture", however, has been called an "evolution of GIME" [Dt15].

### 5.5.3 Corporate Data Model Development

Corporate data model development was the first project initiated by CIS, all other projects being dependent on the existence of the model.

A "fast-track" modelling approach was adopted. Considerable data modelling work had previously been undertaken in Gigante and data analysis units were active in all divisions and most shared resource units. In November 1988, CIS arranged for representatives of

these units to be brought together and, after an intensive 3 week workshop, results from all units had been integrated into Version 1 of the corporate data model.

The next major phase commenced in April 1989, when the corporate data model was partitioned into data subject areas and the data analysis units were asked to "fill out" one or more data subject areas. This exercise lasted 3 months and was controlled by the Gigante Information Centre on behalf of CIS. Since then modelling, at a lower level of detail, has been undertaken by GIME applications development teams. Again, the Gigante Information Centre has coordinated and controlled this work.

The corporate data model has since evolved to a point where it has been judged by an external consultant as suitable both, as a necessarily generalised but accurate representation of Gigante's business, and (with some reservations) as a generally sound conceptual-level systems development data model (Dampney, 1990). Currently, however, Gigante's applications development guidelines state that corporate data model-compliance is not required and that the corporate data model should be used only as a reference point [Dt15].

### 5.5.4 All Products Provisioning System (APPS)

In mid-1989, Corporate Customer Division commenced planning for the development of an All Products Provisioning System (APPS). The new system was intended to be a replacement for Gigante's two provisioning systems: DCRIS, controlled by CNSS, handling service orders for "plain ordinary services"; and RASS, developed by CNSS with control later transferred to Corporate Customer Division, handling orders for special services. Both systems ran on Bull mainframes, while APPS was intended to run on a GACONET IBMC mainframe, using DB2.

Since the project cost was well in excess of $6M, the DMD's endorsement had to be obtained. The APPS business case [Dt2] stated that the system would be GIME-compliant and, from early 1990, Corporate Customer Division negotiated with CIS in an attempt to gain their support for the project.

CIS were concerned that the APPS project team neither understood nor supported GIME [Nt76, Nt84] and that CNSS and the other divisions should play a significant role in APPS development. Thus, negotiations were protracted. Eventually, in August 1990, the EGM Corporate Customer Division withdrew the business case and asked his MIS head to reconsider it (in light of objections raised from CNSS, in particular) [Nt84].

### 5.5.5 Integrated Management Information System (IMIS)

IMIS development came about as a direct result of a SISP study recommendation. Instead of MIS groups managing their own extracts from source system data bases, the task would be performed by the Gigante Information Centre, using IMIS, as a service for the whole of Gigante. MIS groups would then use the IMIS data base as their data source. The intention was to eliminate redundant data base extracts, to protect MIS groups from source system data base structure changes and to ensure that all MIS used a common data source. It was anticipated that the elimination of redundant extracts would result in a marked decrease in total Gigante processing requirements and costs. Development of the intial version commenced in November 1988 and was completed in June 1989.

A senior manager from CNSS was then seconded to oversee future development work. His initial tasks were to secure a commitment from the divisions to use IMIS and to determine their high priority information needs. By December 1989, he had secured the desired commitment but there were doubts about how serious some of the divisions were in their intent to use IMIS [Nt42, Nt48, Nt60]. A further task undertaken by the seconded CNSS manager was an attempt to establish a cooperative working arrangement between the IMIS and Business Management Systems teams. His preferred option was to amalgamate the two teams but this did not prove possible (mainly because this was not acceptable to either GAIS or CNSS).

The choice of DBMS for the IMIS data base created considerable interest in the organisation. This was not unexpected, given that Country and CNSS were committed to ORACLE, Business Management Systems's commitment to TERADATA, GAIS's role in developing the processing architecture and, of course, vendor interests [In2, In18, In25, In27, In31]. In November 1989, the IMIS team decided to switch from IDMS to the GIME standard, DB2.

IMIS work (on DCRIS and RASS extracts) continued through 1990 but CIS expressed dissatisfaction with what they saw as the slow development pace. The Gigante Information Centre component of the IMIS team maintained that their major problem was in getting adequate cooperation from Business Management Systems [Nt60]. By end-1990, IMIS was still not being used to any great extent in the organisation (although development work was still in progress).

### 5.6 SISP IMPLEMENTATION: RESISTANCE

## 5.6.1 EGM GAIS

The EGM GAIS believed that processing was the key to GAIS's future and was very keen to retain his authority over the operation of Gigante's national processing infrastructure and the development of its architecture [In2, In4]. He did not see this as being inconsistent with his strong support for the doctrine of maximum divisional and managerial autonomy and accountability. In his view, the divisions had very different systems needs, they should be free to develop whatever systems they wanted, using whatever products they wanted and GAIS would be their preferred processing shop on a cost/performance basis [In5]. At the same time, he vigorously opposed any attempts by the divisions to do their own processing (or to outsource it) [Nt4].

The EGM GAIS strongly resisted GIME and, in particular, attempts to establish a standard processing architecture [In2, In4]. He saw that relinquishing control over the processing architecture posed a consequential threat to his processing resource ownership and, in turn, this threatened a major source of his power; specifically, his ability to generate funds (both to secure GAIS's future and for discretionary use). Also, the threat to his authority over the corporate processing architecture posed a consequential threat to his involvement in wider decision making processes. For example, decisions on the timing of new product releases meant that GAIS had to be consulted to ensure that GACONET could cope with any new processing demands that the product might generate. Attempts by CIS to secure the cooperation of the EGM GAIS met with little success [Nt41, Nt82].

## 5.6.2 GM National Applications Development

In view of his EGM's emphasis on processing and the establishment of IS units in the divisions, the GM National Applications Development considered that his branch's role as the authorised provider of technical resources for major systems development was under threat [Nt6]. Thus, he saw GIME as an opportunity to secure its future. Consequently, he strongly supported GIME at the beginning, including providing almost all members of the DBMS Standardisation and Applications Architecture Specification project teams. The GM National Applications Development viewed DB2 as the de facto industry standard DBMS of the future and saw the product as a solution to one of his major problems - namely, finding sufficient external contractors proficient in products used within Gigante.

The GM National Applications Development's support for GIME waned in late-1990, when it became apparent that the recently appointed CIO wanted to establish his own information systems direction [Nt86].

## 5.6.3 National Applications Development Project Managers

While National Applications Development project managers supported the GM National Applications Development's position on DB2, they did not share his enthusiasm for GIME. Project managers had always had a great degree of freedom in technical matters and were jealous of their autonomy |In6, In17|. A number of previous attempts to introduce standards had failed, with the result that staff could only be moved between project teams with considerable training and, consequently, the organisation was very dependent on National Applications Development project teams for production systems support.

An aspect of GIME that was of particular concern to the project managers was the role of the Corporate Data Base Administration unit in data base specification, design, development and maintenance. The project managers strongly believed that these activities should remain within project teams and some (at least) were concerned that loss of their data base responsibilities would reduce their organisational influence (gained through their role in information provision) [In6, In42].

Pfeffer (1992) relates many examples of how organisation parties have derived power through control over access to sources of expert knowledge. The Gigante project managers provide another classic example, since they controlled access to the only sources of expertise that had the knowledge to: first, maintain the critically important corporate information systems; and, second, to respond to requests to extract urgently needed information that was buried in the corporate data bases. GIME meant that this power source would be gradually centralised in the Corporate Data Base Administration unit.

## 5.6.4 Contractors

External contractors were used extensively on project teams. In most cases they were brought on to project teams to make up for skill shortfalls. Consequently, despite being outsiders, contractors tended to become very influential team members. Generally, though, their expertise was limited in scope; for example, most contractors were expert in only one or two DBMSs. Significantly, there were very few contractors in Gigante with DB2 skills.

Contractors were among the most vocal critics of the decision to standardise on DB2 and the GIME applications architecture specification [In44]. Quite rightly, they saw GIME as a serious threat to their continued employment in Gigante. Their non-DB2 skills would no longer be required and the Corporate Data Base Administration unit could provide an effective substitute for their expert knowledge.

### 5.6.5 Customer National Support Systems (CNSS)

CNSS had its origins, in the mid-1970s, as a user group managing the development of a major fault management system. Comprised mainly of engineers, the group expanded rapidly during the 1980s, as it took on responsibility for development, implementation and maintenance of further major systems (including the provisioning systems, RASS and DCRIS).

During early 1988, CNSS lobbied successfully for ownership of all significant corporate systems. Their gain was diluted somewhat shortly after this, when Corporate Customer Division wrested control over RASS from them (see 5.6.7.2). However, CNSS jealously guarded (and frequently used) their authority in the major systems area. Reasons for this included: divisions were highly dependent on CNSS to meet their systems maintenance and enhancement requests; anyone wishing to access a major system's data base was similarly dependent; CNSS's control over the major systems meant that they had to be involved in the making of many major (not purely information systems) decisions; and the systems were a major source of funds (through charging the divisions for their services) [In9, In11].

Towards the end of 1987, CNSS began to vigorously promote themselves as Gigante's systems development experts. In this they were fairly successful and the end was accomplished as much by denigrating GAIS's skills as by advertising their own. By end-1988, they had succeeded to the extent that many in Gigante had accepted their message that, first, GAIS had done a very poor job and, second, that CNSS were the natural provider of systems development skills in the organisation [In15].

Apart from some very effective marketing, CNSS accomplished their aims through a strategy based on gaining some control over the processing architecture; specifically, rather than amend a GACONET-based system to meet an enhancement request, CNSS, where possible, would develop and implement the enhancement on a growing distributed network of their own mini and micro computers [Nt5, Nt18]. By adding generous margins onto their development and processor purchase and operations costs, they were then able

to secure funds (from the divisions) for further ventures. Also, by developing their enhancements around the ORACLE DBMS, they were able to lock GAIS (with little ORACLE expertise) out of any of the distributed processing development work.

CNSS claimed to support GIME but their support was only superficial. Their rise to prominence in Gigante had been spectacular and GIME challenged their hard-won gains in systems development, processing and ownership and was resisted [In8, In9, In11]. They stood to lose significant power in terms of: first, their ability to generate funds necessary for survival and discretionary activities; second, their control over access to information; third, their authority over development and ownership of the major corporate information systems; and, fourth, their role in corporate decision making processes. In addition, they had worked long and hard to establish the beliefs of GAIS incompetence and CNSS expertise as important systems of influence. The central role that GAIS had been given in implementing GIME represented significant challenges to these beliefs.

### 5.6.6 Business Management Systems

At the same time CNSS gained control over the major systems they also managed to secure the transfer of the Business Management Systems unit to their organisation.

Business Management Systems were in the MIS business; specifically, the business of extracting data from the major data bases, analysing it and preparing performance reports for management. The divisions were charged for this service and Business Management Systems were dependent on these funds for their survival. Business Management Systems were conscious that, through their information provision function, they played an important role in decision making within Gigante [In25, In34].

The principal source for Business Management Systems's data was the DCRIS data base and their major asset was their detailed knowledge of this data base (built up over many years).

Extracted data was copied to a TERADATA back-end data base machine (marketed and supported in Australia by Bull). Business Management Systems owned the TERADATA machine and were rapidly building up expertise in its use. They believed that TERADATA was the superior MIS platform in Gigante and that they could secure their future through it; specifically, because of their expertise, the divisions would naturally come to them for development of their MIS applications. Also, by owning the machine, they could generate discretionary funds by charging both their end-users and other developers for its use.

The GIME activities that concerned Business Management Systems most were IMIS, the decision to standardise on DB2 and the establishment of the Corporate Data Base Administration unit [In34]. The activities represented significant threats to power that they derived from their expert knowedge, their information provision function and their ability to generate funds. CIS attempted to counter Business Management Systems by amalgamating it with the Gigante Information Centre but this was unsuccessful and had the unfortunate side-effect of slowing down IMIS development (see 5.5.5).

### 5.6.7 The Divisions

### 5.6.7.1 Gigante Business Services

As a major objective, Gigante Business Services aimed to increase its autonomy. At one senior management meeting they argued (unsuccessfully) that their organisation unit should be hived off from Gigante as a separate subsidiary. This objective was reflected in their information systems approach where they wanted their own processing facilities, running their own systems. They were anti-GAIS and had no wish to cooperate with other divisions in joint developments [In22].

The organisational value of maximum divisional and managerial autonomy was a major system of influence in Gigante. Gigante Business Services (in common with the EGM GAIS, the project managers and Country) saw GIME as inconsistent with this value and they invoked the system of influence in support of their objectives. By mid-1989, they were well advanced in their plans to develop and implement their own systems. A package was selected as the solution and processing would be performed in-house, using Gigante Business Services's own non-GACONET facilities. CIS objected and after negotiation, with the DMD involved, a compromise was reached. The development could go ahead, but only as an interim solution. In addition, Gigante Business Services were to develop a plan to phase out their package and use GIME systems when these were developed. Despite pressure from CIS, no real planning to this end was done. The Gigante Business Services strategy was to ignore CIS and GIME (to the extent possible), in the belief that the strategy would die a natural death [Nt35, Nt39, Nt40, Nt45, Nt77].

### 5.6.7.2 Corporate Customer Division

Corporate Customer Division was the first division established and (justifiably) it was very concerned about the ability of Gigante's systems to support its operations. In

particular, Corporate Customer Division's inability to get a consolidated picture of its large corporate customers' dealings with Gigante was a major worry.

Corporate Customer Division argued that enhancements to the RASS system represented the most promising means of achieving their immediate systems aims [Nt7]. In this they were strongly supported by the Fujitsu Gigante Account Manager who maintained that a necessary first step was a line-by-line conversion of the Bull-based RASS system to Fujitsu's IBMC equipment (with its more productive development environment). He further argued that the conversion could be accomplished quickly and inexpensively.

These arguments were spurious but, nevertheless, were successfully used by Corporate Customer Division to wrest control of RASS from CNSS.

After taking over RASS, Corporate Customer Division did not convert the system to IBMC, nor did they undertake any major enhancements. Instead, by mid-1990, Corporate Customer Division was well advanced in its plans to develop APPS as a replacement for both RASS and DCRIS. Corporate Customer Division then approached CIS with a view to securing their support for APPS development. As noted previously, negotiations were protracted and the APPS business case was eventually withdrawn (although, this did not lead to an immediate stop in development).

Corporate Customer Division expressed no great interest in owning or controlling its own processing facilities and its members supported GIME - but only to a point. They willingly provided resources for GIME projects and were prepared to use the DBMS standard, DB2. However, when (during APPS development) the scope of the Corporate Data Base Administration role became apparent, they objected. In part, their resistance emanated from the APPS project team's desire for autonomy [In16]. More important, though, was the threat to applications ownership. That is, the Corporate Customer Division IS Manager was more aware than most that control over information provision, through ownership of data, leads to a central role in the decision making process and was reluctant to relinquish any control over an important corporate data base [In21].

### 5.6.7.3 Gigante Residential Division

Gigante Residential supported GIME and, in particular, development of the corporate data model.

However, a significant problem faced by the Gigante Residential Mgr IS was controlling information systems activity within his division. In one case, the Sydney North Gigante Residential region invested millions of dollars and had over 50 people employed in developing a separate set of systems for the region. The development was based around a local version of a corporate-wide data model (not consistent with the corporate data model). When the development came to light, the decision was made to let it proceed (on the grounds of not wanting to waste money already invested) [Nt90].

### 5.6.7.4 Country Division

Most information systems activity in Country centred on improving the availability and quality of management information. Country's solution, though, was largely technology-driven, starting with the premise that they must process their own management information systems locally, under UNIX using the DBMS ORACLE. In common with CNSS, they believed that UNIX / ORACLE was the *only* route to an open systems environment and succeeded in having this belief accepted in a number of other areas of the organisation [In31].

Country were strong supporters of the doctrine of maximum divisional and managerial autonomy [In33] but were prepared to use corporate systems developed, within GIME, by other divisions. They did not object to GAIS involvement in the development of their systems but, like Corporate Customer Division, wanted to own their own systems and data [In30]. Country saw themselves as expert in the decision support systems area and believed they could generate funds by selling both their MIS development skills and their processing facilities to other areas in Gigante in the MIS business [Nt29].

The IMIS project and the decision to standardise on DB2 threatened Country's systems development and processing plans and, consequently, funds generation and information provision power derived from their involvement in these processes. Thus, they resisted both these initiatives with some determination [In30]. On other GIME initiatives they were fairly neutral.

### 5.6.8 Vendors

Traditionally, the two authorised computer equipment suppliers to Gigante (Bull and Fujitsu) enjoyed a privileged position. Not only did their long-term contracts generate considerable revenue (including processor maintenance revenue), but they also played an important role in development of the GACONET processing architecture and were

an integral part of the decision-making process (because most major business initiatives depended on information systems support).

By the late 1980s though, Bull's position was under serious threat [In1]. Gigante still had a dual-supplier policy but almost all new development work was being done on the IBMC computers supplied by Fujitsu. Bull was still supplying mainframes to Gigante, but only to meet DCRIS demands (which were expected to level off from the early 1990s).

The problem that Bull faced at the commencement of the DBMS Standardisation project was that only their proprietry DBMSs would run on their mainframes. Fujitsu's major concern was that a Bull proprietry DBMS would be selected, although, given the selection criteria, they considered this unlikely.

Bull's response was to develop a comprehensive strategic solution to the complex technical problem of migrating existing systems to GIME [Nt56]. Their solution relied on the use of distributed UNIX-based Bull mini-computers and the TERADATA back-end data base machine (which provided good inter-connection with both Bull and IBMC mainframes). Their solution had considerable technical merit but (understandably) was heavily dependent on the use of Bull products. After protracted consideration, the proposal died.

With their influence in Gigante diminished, and with the failure of their GIME migration proposal, Bull pursued the same approach as other non-authorised IT vendors in Gigante; i.e. getting products into the organisation "through the back door". ORACLE had been successful in this way with CNSS and Country [In27, In31]. Bull, in turn, managed to convince Business Management Systems of the virtues of the TERADATA machine, resulting in a consequent adverse effect on the IMIS project [Nt59, Nt60].

## 5.7 MANAGEMENT OF THE SISP CHANGE PROCESS

### 5.7.1 Conflict Prediction

In the latter stages of strategy development, SISP study team members were directed to "sell" the strategy to Gigante's senior executives. Contrary to the approach suggested in this thesis, no serious attempt was made to predict all likely sources of resistance in advance.

As a result, CIS encountered much resistance which was not planned for; for example, from GAIS project managers, contractors and vendors [In6, In17, In18, In41, In44]. Also, by not identifying the reasons behind potential resistance, opportunities were lost. For example, had the strategy team offered the EGM GAIS the responsibility to implement the rationalised processing architecture, this would have addressed his key concern; namely, that his control over processing architecture development (and, consequently, processing operations) was threatened [In2]. By not doing so, an opportunity to secure the cooperation of a party vital to successful strategy implementation was lost. Instead, the EGM GAIS resisted strategy initiatives at every opportunity - even where these initiatives did not conflict with his own key objectives.

Pfeffer (1981) and others have noted that, in uncertain situations, action often results from bargaining and compromise; particularly where there are significant authority-task gaps (Lippitt and Mackenzie, 1976), as in the case of the Gigante SISP implementation (see 5.7.4). Successful bargaining, though, depends on knowledge of what is important to the various stakeholders (i.e. what are their power sources and which of these do they value). MP/L1 is designed to assist in revealing this knowledge.

## 5.7.2 Business and IS Strategy Alignment

Many researchers (see for example, McFarlan et al., 1983, Boynton et al., 1987 and Broadbent, 1990) have emphasised the importance of aligning information systems strategy with business strategy. In Gigante, information systems strategy was developed *after* the new business direction had been developed, accepted and (to a large extent) implemented.

The McKinsey recommendations were, essentially, that the organisation structure should be flatter, that operations should be devolved, that divisions should have maximum autonomy and that managers, to the lowest level possible, should be accountable. This style of organisation demands that information systems be tightly integrated at the logical level if corporate management are to be able to effectively monitor and control the overall operations of the business (Butler Cox, 1987). Systems integration, through a data-centred approach, was of course the major recommendation of the SISP study and, had information systems strategy been developed in parallel with business strategy, it is possible that SISP recommendations might have been more readily accepted. In particular, SISP recommendations could have been more effectively explained and sold in terms of business needs and information systems strategy could have been implemented as an integral part of the new business strategy.

## 5.7.3 Structural Difficulties

Markus (1983) and Markus and Robey (1988) have stressed that resistance to MIS implementation can be reduced if organisation structure problems are addressed first.

In retrospect, strategy implementation was always going to be difficult after the head of the strategy development team conceded that the strategy would not recommend any major changes to the GAIS organisation structure [Nt3]. His reasoning, that this was necessary to secure some measure of cooperation from the EGM GAIS, was probably right. The effect, however, was to make strategy development easier at the cost of strategy implementation.

Largely because of this concession, at least three major IS-related structural anomalies were not corrected.

First, GAIS and CNSS were in the same business, fighting for control of the information systems function in Gigante, and reluctant to relinquish control or authority over any process [In2, In4, In8, In9, In11, In24]. Thus, CIS was hardly able to make a move without meeting resistance from GAIS or CNSS (or, in some cases, both). Amalgamation of CNSS and GAIS, as part of strategy implementation, may well have diminished the level of resistance.

Second, a data-centred approach demands a special type of information systems organisation structure (DCE, 1989). Specifically, the Corporate Data Base Administration unit should have been given control and authority over data base functions carried out by project teams and GACONET technical support. Had this been done early, Corporate Data Base Administration may have been better placed to develop cooperative working arrangements with project teams [In6, In42].

Third, responsibility for strategy implementation might have been better placed under the DMD (who had line control over GAIS, CNSS and the divisional IS units), rather than in Corporate Strategy (which reported straight to the MD). Apart from allowing the development of clearer lines of authority, this would have eliminated conflict between the head of Corporate Strategy and the DMD as a threat to strategy implementation [Nt55, Nt69].

By late 1989, information systems structural difficulties were sufficiently troublesome for the DMD to initiate moves to appoint a CIO who, it was planned, would head up a

new Information Technology Group. The initial Information Technology Group was to be formed by amalgamating GAIS and CNSS.

CIS supported this move but recognised that it put the strategy and GIME at risk [Nt55]. These fears proved justified when it became apparent that the appointed CIO (who commenced in July 1990) wanted to pursue his own information systems direction and that this was not consistent with GIME [Nt68, Nt70, Nt83, Nt86, Nt87, Nt88]. It seems likely that successful strategy implementation would have been much more likely had the CIO been appointed prior to implementation commencing [In38].

### 5.7.4 Uncertain Authority

The structural difficulties discussed above, combined with CIS's lack of direct control over operational units [Nt22], meant that information systems authorities were very uncertain. Some organisational units took advantage of this to pursue their own aims at the expense of the strategy [Nt40].

Lindner (1989) suggests the use of a champion as a change agent if this is consistent with the organisation's familiar mode (see 2.3.2). In Gigante, champion-based processes were typically used to effect major change (for example, to implement the McKinsey recommendations). This approach would probably have improved the chances of a successful SISP implementation; especially as authorities would have been made more certain by temporarily vesting power in the strategy implementation champion. Even so, it is unlikely that this approach would have been successful unless it was adopted as part of a total, coordinated, change management process that addressed the issues discussed elsewhere in this section.

### 5.7.5 Short-Term Results

When the SISP was endorsed, it was made clear that early results were expected [Nt22]. Long lead times are a recognised hazard of implementing data-centred environments (Sager, 1988b), but CIS might have done more to produce and publicise early deliverables.

Many in the organisation were skeptical about the worth of corporate data modelling [Nt12, Nt18] and CIS's achievement in producing Version 1 of the corporate data model by end-1988 was significant. Unfortunately, a data model is not a "concrete" deliverable and more effort might have been put into producing a small system, addressing some high-profile business need (for example, lost revenue caused by the inadequate linkage

between provisioning and billing systems - see Nt43). This short-term deliverable need not have been totally GIME-compliant, but it could have been made to look like GIME and sold as such.

Also, the applications architecture should have been produced sooner [In37]. Those in the organisation that wanted to produce GIME-compliant systems were frustrated by the lack of standards and guidelines [Nt35, Nt57] and more effort might have been directed towards the production of a "minimum set".

## 5.7.6 A Compelling Deadline

Another change anchor proposed by Lindner (1989) is the use of a compelling deadline. In the Gigante case study, opportunities to take advantage of compelling deadlines were missed.

For example, Gigante Business Services and Corporate Customer Division were both adamant that the existing provisioning (or service orders) systems, DCRIS and RASS, were inadequate [Nt7, Nt8, Nt9, Nt12] and used the threat of competition to argue for their urgent replacement. CIS could have strongly supported this argument and fostered competition between CNSS, Gigante Business Services and Corporate Customer Division to produce GIME-compliant development proposals [In43]. The service orders development activity was large and could easily have been partitioned - a fundamental tactic identified by Leonard-Barton (1988). Thus, CIS might have been able to negotiate agreements whereby all three parties were given significant roles in the development process.

## 5.7.7 Setting the Agenda

Pfeffer (1981) identifies agenda setting as an important political tactic. The Management Information Strategy Unit strategy development team failed to do this concerning implementation costs [In29]. That is, the team missed an opportunity to define the parameters for the debate on costs.

The reason the Management Information Strategy Unit failed to produce detailed costings was because its head feared that discussion on strategy acceptance would be bogged down in trivial argument on cost derivations [Nt20]. The EGM GAIS, though, was able to take advantage of the lack of detailed costings to attack the credibility of the whole strategy [Nt21, Nt53]. A better approach would have been for the Management Information Strategy Unit to produce costs with a focus, not so much on implementation

costs, but on what the existing information systems environment was costing the organisation (particularly in terms of lost business opportunities).

## 5.8 INTERLUDE: A RATIONAL CHOICE PERSPECTIVE

Much resistance encountered can be explained from a rational choice perspective. Attacks on the data-centred approach by CNSS and Gigante Business Services were certainly reasonable given industry experience (Doll Martin Associates, 1990); as were attacks on the DB2 decision by Country, CNSS and Business Management Systems; the EGM GAIS was certainly justified in querying costs; it was reasonable of Gigante Business Services, Corporate Customer Division and Gigante Network Engineering to claim they needed short-term solutions to their systems' problems; and the EGM GAIS was right to question whether the strategy was consistent with the move to autonomous business units.

Had CIS conducted an early, detailed analysis of all these objections, it is possible that the strategy might have been revised or extended with beneficial results. For example, analysis of the data-centred objections could reasonably have led to the conclusion that success was unlikely with the existing organisation structure and uncertain authorities. Thus, structural anomalies might have been corrected early, rather than in mid-1990, by which time it was too late (see 5.7.3).

Nevertheless, the weight of evidence suggests that rational arguments were advanced (at least in part) for political reasons. This is reflected in the following examples: Corporate Customer Division's RASS takeover was inconsistent with its criticisms of the system [Nt8, Nt9, Nt10]; the EGM GAIS's support for divisional autonomy was inconsistent with his resistance to any threat to his control over the processing architecture [In2,In36]; Gigante Business Services's insistence on a package solution disregarded Gigante's very poor record with packages; (see 5.3.3) and the GM CNSS was adamant that he would oppose any initiative involving replacement of his largest system, DCRIS [Nt44].

Thus, the Gigante case study provides support for the argument (advanced in 2.3.3 ) that, while the power model is well-suited to the task of conflict prediction, conflict instances should be closely examined from both power-political and rational perspectives. That is, much resistance will occur as a result of threats to power sources but it is also possible that the strategy has faults and can be improved upon.

One consequence of the above is that strategy development and implementation should not be treated as discrete consecutive activities, but should be integrated. Provan (1989)

has argued that internal organisational power aspects must be an input to strategy development to ensure that any strategy (developed from a rational-choice perspective) is realizable. Conversely, resistance encountered during strategy implementation may have a sound rational basis and, perhaps, is an indication that elements of the strategy resulted more from power plays (among developers) than from logic-based processes (see, for example, the pre-SISP study agreement on GAIS restructuring discussed in 5.7.3).

## 5.9 THE CASE STUDY AS RESEARCH PLATFORM

The case study revealed a number of important functions and conflict strings relevant to the SISP implementation domain [In3, In7, In10, In12, In13, In14, In16, In20, In23, In26, In35, In39, In40]. These findings assisted in the development of the power source network, presented in Figure 3 in 3.4.3 (and in more detail in Appendix 1) and implemented as part of the MP/L1 expert system.

As indicated earlier, the broad MP/L1 framework was developed from the power model and MIS literature during the early stages of the case study. Later, case study findings were used to validate, refine and expand the framework. In particular, the case study was used to identify important SISP activity specific processes (critical functions) and the links between them.

For example, the study revealed that applications ownership is an important SISP implementation activity specific power source because: first, it is a source of funds (for example, to Corporate Customer Division, CNSS and Business Management Services); second, it leads to end user dependence through being able to control the ordering of maintenance programme priorities (important to CNSS); third, it leads to an important role in information provision through control over the specification of data base updates and data base access (important to Corporate Customer Division in particular); and, finally, because being an authorised application owner leads to a role in the wider decision making process (highly important to CNSS). Similarly, processor provision, processing architecture development, applications development and the application of organisational rules were other activity specific processes identified that linked in with higher-level generic power sources. Details of the derivation of MP/L1 power source links, from case study notes, are presented in Appendix 3 but, most significantly:

> - resistance encountered from the EGM GAIS, CNSS, Business Management
>   Systems and Country led to the establishment of MP/L1 links from processing
>   architecture development to processor ownership to funds generation [In3];

- the link between processor provision and funds generation was taken as axiomatic [In7];

- resistance encountered from the project managers, CNSS, Gigante Business Services, Business Management Systems and Country led to the establishment of a link from applications development to funds generation [In10];

- resistance encountered from Corporate Customer Division and Business Management Systems led to the establishment of a link from applications ownership to funds generation [In12];

- resistance encountered from Corporate Customer Division, CNSS, Business Management Systems and the project managers led to the establishment of links from applications ownership to specifying data base updates and approving data base access to information provision to decision making [In20];

- resistance encountered from Corporate Customer Division and CNSS led to the establishment of links from authority over applications development and ownership to approval to decision making [In23];

- several instances of resistance encountered from the EGM GAIS led to the establishment of links from authority over processing architecture development to approval to decision making [In35];

- resistance encountered from Bull, CNSS and Country led to the establishment of a link from processor provision to processing architecture development [In39];

- several instances of resistance encountered from Bull led to the establishment of links from authority over processor provision to approval to decision making [In40]; and

- resistance encountered from project managers, CNSS and Country led to the establishment of links from applications development to knowledge provision to information provision to decision making [In6, In9, In17, In44].

Significant case study conclusions were that resistance was not predicted well, that the power model could be used to explain much resistance, that the power model might have been effective in predicting resistance and that the prediction process could be

automated. These findings were translated into the refined research question and hypotheses presented earlier (see 4.3).

Finally, information extracted from the case study was employed in the laboratory experiment phase of hypothesis testing. Specifically, the background material given to experiment subjects (see Section 2 of Appendix 2) and the set of conflicts relevant to the APPS implementation project (see Section 5 of Appendix 3) were both extracted from the case study report and data base.