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Understanding Information Systems Evolution and Management through an Analysis of Power, Power Sources and Stakeholder Dependencies: A Case Study

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The important role that organizational power and politics can play in information systems (IS) management has received considerable attention over the years. Stakeholder dependencies, based upon power sources, are integral to organization power. An analysis of such dependencies during the life of an insurance industry IS is presented. Formal Social Network Analysis (SNA) methods are employed to specify, depict and analyze dependencies, which may be used to explain much that occurred in the evolution of the IS. It was concluded that use of the methods detailed in this study may well position stakeholders to understand and respond to threats and opportunities that may arise in a rigorous and informed manner.

FOR Code: Information systems management

1. Introduction

Bolman and Deal (1991) identified four frames through with organizational life can be studied and understood: the *structural* frame, the *human resource* frame, the *symbolic* frame and, finally, the *power/political* frame. Much information systems (IS) activity changes the distribution of power among major stakeholders and, as a corollary to this, power may be used to explain much IS activity (see e.g. the seminal paper of Markus, 1983).

In common with Pfeffer (1981), it is our view that power (and politics) is neither good nor bad but is simply a 'fact of life' that needs to be taken into account in both IS research and practice. Moreover, it has long been recognized that, at its heart, power is fundamentally concerned with *dependence* and, some 50 years ago, Emerson (1962: 33) formally defined the power of *A* over *B* as equal to the dependence of *B* upon *A.*

In this paper, we detail a case study into an insurance information technology (IT) system designed to improve links between brokers and underwriters. From its inception, the system evolved substantially and, in parallel with this, so did its stakeholders, their roles and their ability to influence key decisions relating to system maintenance/enhancement and its management. An analysis of stakeholder relationships and dependencies (and the dynamics of these) was the lens chosen to facilitate an understanding of the events that occurred during the (fairly turbulent) life of the system. Formal Social Network Analysis (SNA) methods (Hanneman and Riddle, 2007) were employed in the specification, depiction and analysis of

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dependencies. From a practitioners' viewpoint, use of the methods detailed in this study may well position stakeholders to understand and respond to threats and opportunities resulting from IS-induced change in a rigorous and informed manner.

Our paper is organized as follows: background to our study is presented in the following section and this is followed by a brief introduction to the research design. The case study is then presented, followed by a discussion on findings and a suggestion for an extension to the analysis approach. The final section contains concluding remarks.

2. Background

2.1 Organizational Power and its Determinants in IT Management

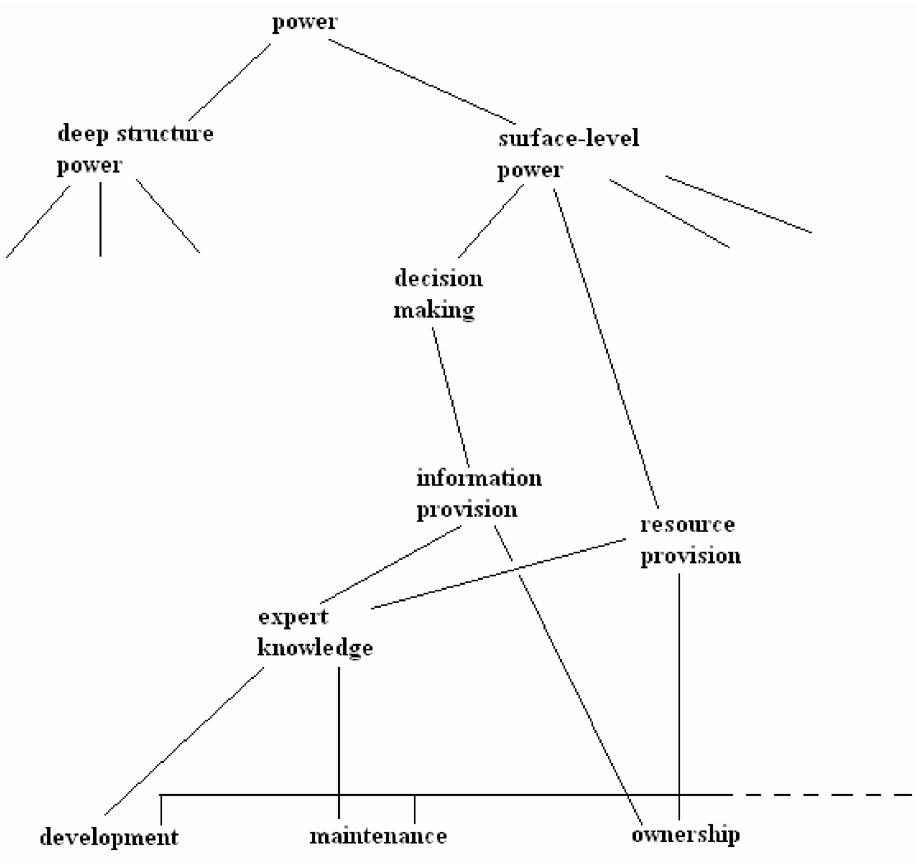
This treatment of organizational power within the IT domain employs and extends earlier research into a *model of power in first-order logic (MP/L1)* first presented in (McGrath et al, 1998). At the core of this view of power is the concept of *dependence* and, specifically, that party *A* has power over party *B* if *B* is more dependent on *A* than *A* is on *B* (Emerson, 1962).

Many organizational theorists have presented frameworks through which power can be described and understood. House (1984) analyzed the then available power model literature and synthesized it into 61 compound propositions, each consisting of several parts. Thus, organizational power is a complex phenomenon, it has been widely studied and has a rich literature base. The initial version of MP/L1 was based largely on Pfeffer's *power sources* concept (Pfeffer, 1981, 1992) and, more specifically, on the *power source distribution* model presented by Markus (1983). Frost's *deep structure power* concept (Frost, 1987) was also incorporated into the model. This limited selection of power model expertise was chosen as the basis for the initial version of MP/L1 purely because, in the authors' view, it showed considerable promise as a framework in which important aspects of the IT management domain could be specified in a way *useful* to practitioners in the field. Furthermore, space restrictions do not permit the complete listing and justification of all our model's rules here. Instead, we focus on the association of dependence with power sources. A complete specification of the original MP/L1 model is presented in (McGrath, 1993).

Pfeffer (1981) 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). Many organization decisions may result in a perceived and/or real redistribution of power sources. There are winners and losers, and losers may *resist* change. It is this concept that is at the heart of the MP/L1 model mentioned above and, while resistance is not automatic, Pfeffer contends that it is likely: i) where there is disagreement about goals and objectives; ii) where uncertainty exists about the means required to achieve objectives; iii) where resources are scarce; and iv) where decisions are important. We maintain that all these are characteristic of much that occurs in the IT management domain.

Generic power sources may be represented as a network and linked to IT involvement roles as indicated in Figure 1. As an example, a party responsible for system *development* and/or *maintenance* has power because others are dependent on that organizational actor's *expert knowledge* (particularly if that knowledge can not be obtained from other sources – i.e. the party is *irreplaceable).* Furthermore, that expert knowledge may mean that the party plays an important role in *information provision* and, consequently, may also have a significant impact on *decision making.* Thus, other actors may be heavily dependent on that party in a variety of ways. Such dependencies are clearly evident in our case study and may be used to explain much that occurred. We expand upon this in a later section.

Figure 1: Power source network.

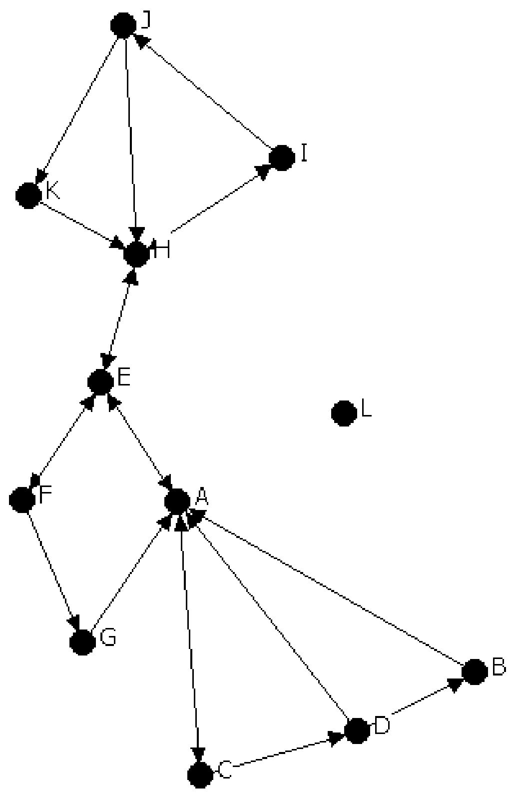


2.2 Social Network Analysis

Social Network Analysis (SNA) (Scott, 2000) has long been used within the social sciences (see e.g. Radcliffe-Brown, 1940) to analyse phenomena such as links between ethnic groups within neighbourhoods, and the identification of cliques, power structures, norms and information flows within social groupings. Within SNA, the interaction patterns describing social structures can be viewed as a network of relations. The central tenet is that parties' beliefs, feelings and behaviour are driven not by attributes of the aforementioned parties, but by the relationships between them. The network paradigm is ideal for examining organizational phenomena because it refocuses attention away from parties acting in isolation to a much wider view that sees these parties as nodes in an interconnected set of interdependent relationships embedded within wider organizational and social systems (Zack, 2000).

Network relationships may be represented as 'sociograms'. An example, specifying a communications network is presented in Figure 2. A quick glance at this diagram tells us that there appear to be three distinct *cliques* within the network *({A,B,C,D}, {A,E,F,G}* and *{H,I,J,K}).* In addition, *A, E* and *H* all appear to be situated at vital points within the network: and, in fact, *A* is called a *cut-point* (because its removal would create two disconnected components) and *E-H* is called a *bridge* (because the link provides a bridge between clearly-distinct network components. *L* is described as an *isolate* (for obvious reasons) and *F,* among others, performs the role of a *conduit* (for messages from *E* to *G).* A further point to note is that this graph is *directed* (i.e. it contains directional arrows). If we were interested in something like 'friendship' (rather than communication), we would only require an *undirected* sociogram (because friendship is necessarily mutual). Finally, we could annotate each link in Figure 2 – to indicate, for example, the number of messages (strength of the link) or the overall tone of the directional communication (positive or negative).

Figure 2: A communications network represented as a sociogram. (Prepared using the SNA drawing package, *NetDraw* (Borgatti, 2002).)



Sociograms often provide a very useful, visual representation of the interactions within a social network. As networks increase in size though, graphical representations often become unwieldy and difficult to manage. Consequently, it is often preferable to work with various, underlying matrix representations. There are different types of these but the *adjacency matrix* is probably the most common and the matrix equivalent of the network in Figure 2 is presented in Table 1.

Table 1: Underlying matrix representation of the sociogram in Figure 2.

	1 A	2 B	3 C	4 D	5 E	6 F	7 G	8 H	9 I	10 J	11 K	12 L
1 A	0	0	1	0	1	0	0	0	0	0	0	0
2 B	1	0	0	0	0	0	0	0	0	0	0	0
3 C	1	0	0	1	0	0	0	0	0	0	0	0
4 D	1	1	0	0	0	0	0	0	0	0	0	0
5 E	1	0	0	0	0	1	0	1	0	0	0	0
6 F	0	0	0	0	1	0	1	0	0	0	0	0
7 G	1	0	0	0	0	0	0	0	0	0	0	0
8 H	0	0	0	0	1	0	0	0	1	0	0	0
9 I	0	0	0	0	0	0	0	1	0	1	0	0
10 J	0	0	0	0	0	0	0	1	0	0	1	0
11 K	0	0	0	0	0	0	0	1	0	0	0	0
12 L	0	0	0	0	0	0	0	0	0	0	0	0

The matrix presented above was prepared using the SNA software package *UCINet* (Hanneman and Riddle, 2007), which was employed for all SNA data analysis conducted during this project. *UCINet* contains an extremely comprehensive range of SNA algorithms and the following operations on our example matrix provide an indication of the types of investigation that might be carried out using this software:

- The network *density* is 0.152. This is the proportion of all possible ties between actors that are actually present. 0.152 is quite low and perhaps suggests that information may take some time to diffuse through the network.
- *Reachability* signifies whether there is a path (of any length) between pairs of actors. If some actors can't reach others it may signal potential division in the network or it could be indicative of more than one sub-population. Excluding *L,* all actors in our network can reach all others.
- *Distance* is the minimum path length from one actor to another (also called the *geodesic).* For example, the distance from *A* to *C* and *E* is 1 but the *B* → *K* geodesic is 6. Small distances may represent stronger ties.
- *Maximum flow* is the number of actors in the immediate neighbourhood of a source that lead to a target. Most maximum flow values in our network are low (1, or 2 in a few cases), signifying vulnerability (in the sense that actors might easily be cut off from information flows).
- *In-degree* and *out-degree* represent the number of links to and from an actor from its immediate neighbourhood (i.e. path-length = 1). A high in-degree (e.g. *A* = 5) could indicate that an actor is an information 'sink', while a high out-degree (e.g. *E* = 3) might indicate that an actor is an information 'source'. Various algorithms are available within *UCINet* to calculate normalized in and out-degree measurements and applying Freeman's (1978) particular approach clearly shows that *A, E* and *H* are the major information sinks within our network but there is much less variance insofar as information sources are concerned. It has, of course, long been recognized that information is a major source of power within organizations (see e.g. Pfeffer, 1981 and 1992). More accurately, perhaps, it is one's position within the communications network that is important.
- *Betweenness* measures the extent to which an actor is in a favoured position by being on paths between other actors ('favoured' in the sense that the actor is in a good position to act as a broker). Again, *A, E* and *H* are best-placed here.

The above represents only the 'tip of the iceberg' in terms of the analysis that can be undertaken with *UCINet.* Further examples will be presented later in the paper. Finally, modern SNA methods can be traced back to Moreno (1953) and, almost without exception, are based on the *sociogram* and its underlying adjacency matrix representation (commonly referred to as a *sociomatrix).* The SNA research community has developed an extremely impressive range of algorithms that may be employed to manipulate sociomatrices in order to provide various measures for the network features of interest outlined earlier (clusters, centrality, influence etc.). In recent years, the social networking phenomenon has provided something of a boost to SNA research, as many of those interested in this domain have come to realize that traditional SNA methods can be used to very good effect in their studies (*cf* SocialCom, 2009). Despite, modern social networking being largely a result of advances in information and communication technology (ICT), surprisingly SNA research methods have taken very little advantage of these advances. Thus, an additional motive underpinning this research is the advancement of SNA research methods: in particular, the longitudinal approach taken can be viewed as a step towards dynamic modelling of social networks.

3. Research Design Overview

This research was conducted as a retrospective and exploratory case study (Yin, 1994). The broad research question addressed was:

> *To what extent do stakeholder dependencies based on power sources influence IS evolution and the management of same?*

As noted, the study concerned an Australian insurance IT system designed to improve links between brokers and underwriters. The system was not especially large or complex but it did have over 600 users (insurance broking and underwriting companies), both its functionality and stakeholder mix changed substantially over its life (more than 20 years) and its maintenance and enhancement activities were eventually outsourced. In that sense, it is typical of a great many contemporary IS.

The first author is an experienced IS professional, having undertaken a wide variety of design, development and project management tasks during her IT contracting / consulting career (over 30 years). Her involvement with the case study system stretches back from the present to 1989. During this period, she has had excellent access to much important archival material (including billing data, costing reports, change requests and project planning documentation) and she has supplemented this information with her own diaries and interviews with key stakeholders. Her experience (length and breadth) provides her with a perspective that a younger researcher would likely not possess (particularly an academic with little in the way of practical industry experience). She worked for the IS Company on 2 occasions, totalling 4.5 years. In addition, she worked on the same software while employed by some of the IS Company's clients; one underwriter for 1 year and 2 brokers for 0.5 years.

Again, as noted, data analysis was largely based on SNA methods and techniques and these were used to specify, depict and analyse power-based dependencies through the life of the system. Thus, using Bolman and Deal's (1991) approach, the power/political frame was selected as the dominant investigative lens. This is not to deny the validity or usefulness of the alternative frames but the case for the power model has been put forward by many eminent researchers in organization studies;

including Frost (1987), Kling (1984), Markus (1983) and Pfeffer (1981, 1992). Finally, as noted in the previous section, an additional motivation in undertaking this study was to advance SNA research methods (specifically, by using recent advances in ICT to facilitate a longitudinal – or dynamic – view of network evolution).

4. Case Study Findings

4.1 The Insurance Information Technology Solution (IITS)

The company providing the insurance information technology solution (IITS) will be hereafter referred to as the 'IITS' company. Its mission statement was then: "*our objective is to enhance the success of our customers in the financial services industry by integrating products, services and technologies to solve their ongoing business needs*."

In brief: IITS's core business is in providing insurance information technology to insurance companies (both brokers and underwriters) in all areas — hardware, networks and software services. The IITS company is a one-to-many IT service provider and utilises a control file with many parameters, in order to be able to customise its functionality to meet the individual needs of clients; both brokers and underwriters. IITS began as one company, then split into a main company and a subsidiary company and then finally recombined. The main company supplies a private network, (an electronic go-between,) between insurance brokers and about 12 insurance underwriters, of which 5 became major shareholding underwriters (CIC, CU, MM, RSA, Zurich) and 7 were participating underwriters, such as NZI. The subsidiary company supplies *general insurance software* and *hardware* to their clients, hardware specifically for insurance brokers, as underwriters have their own IT departments. IITS software deals with all types of general insurance.

The insurance underwriters mentioned above, both major and participating, are substantial stakeholders in IITS and IITS is fortunate in that it can always fall back on these stakeholders. Over the years, they have contributed to IITS's development costs, when necessary and carried its losses. These stakeholders complain from time to time about costs and profits, but they would be extremely reluctant to desert IITS, they can only constrain its budget. IITS had been in the red for over a decade, but finally began to show a healthy profit in the late-1990s.

The most significant reason for the improved financial performance is that the network side has gone ahead and that the ongoing transaction fees are lucrative. IITS wants to further expand this network into overseas markets. This particular network, unlike the internet, can largely guarantee transaction delivery and this is very important to the conservative and security-conscious insurance industry. For most of the period it has been in existence, there has been no effective competition for it.

The network, called *Unilink,* was EDI-based. It was offered to clients as a value-added product and as an alternative to them designing and managing their own IT network. The term *value-added* refers to the extra value added to communications by the telecommunications and computing services these networks provide to clients. Clients do not have to invest in network equipment and software or perform their own error checking, editing, routing, and protocol conversion. Subscribers may achieve savings in line charges and transmission costs because the costs of using the network are shared among many users. The resulting costs may be lower than if the clients had leased their own lines or satellite services.

The reason behind the losses incurred early on was that there were significant problems with the general insurance software side of IITS's operations: specifically, the help-desk facilities and software maintenance were poorly managed, with neither of these operations being billed for in the early days of IITS (when the management were PC salesmen). After the underwriters took over IITS, they introduced charges for telephone 'help' calls and for software maintenance. The number of help calls then halved overnight. There were also a significant number of instances of lost versions of software out in the field. At various times, IITS was prepared to tolerate a loss on the software side in order to obtain a client's business, particularly to get the client onto their network, so that ongoing transaction fees would eventually make good the initial losses. More detail is provided in the following sections, where IITS's history is broken into three major (and fairly distinct) phases.

4.2 Phase 1: Late-1980s – Early-1993

The founder and owner and CEO of IITS was a PC salesman at a time when PCs had a lucrative margin. In order to make a niche market for himself, the owner had a general insurance software package written and installed on his PCs, as a value-add. He toured Australia looking for insurance brokers who would buy his PCs, with the installed software product included as a sweetener.

He saw his profit in the hardware and not in the software. He envisaged the software as being a fault-free, easy-to-use, simplistic product that would be the sweetener for his hardware. He thought that the software would be somewhat like Word for Windows, with minimal contact with clients after the contracts were signed. He provided new brokers with a three-day training course on his software and thereafter he did not expect helpdesk telephone call assistance to exceed 3-4 calls a year. Software version control and software maintenance agreements were not even considered. He did not want to know about the brokers' problems once the initial deals were finalised and monies were paid. Brokers' staff turnover, and consequent learning curves, never occurred to him. In one of his speeches he likened the software to a piece of music on a record; it was written once and could be sold many times over with no ongoing modifications.

IITS's owner might well be described a 'corporate psychopath' (Clarke, 2005; Babiak and Hare, 2006). He was frequently incensed with the supposed incompetency of his helpdesk staff. He thumped and shook and struck the screens surrounding his helpdesk staff almost daily, while he berated them for their incompetency in dealing with the brokers. He could not understand why there were so many telephone calls. What were they doing that brokers' staff kept ringing up? He gave his staff little constructive instruction and he never thought of charging the brokers for this type of helpdesk service. His staff turnover was very high, such as, at one particularly bad point, 13 people leaving in 13 weeks, at the rate of one a week.

He thought of IITS as a cash cow with a series of one-off sales to brokers. He wanted his programming staff to convert brokers onto his system at the rate of about 2-3 per week. The programmers were expected to work on weekends for nothing. With every new client, the help desk telephone calls increased. Also, over time, the clients/brokers versions of software "out in the field." became more and more out of sync with the current product and his support costs rose. The only way out of spiralling costs, as he saw it, was to keep selling his product to new brokers at an increasing rate.

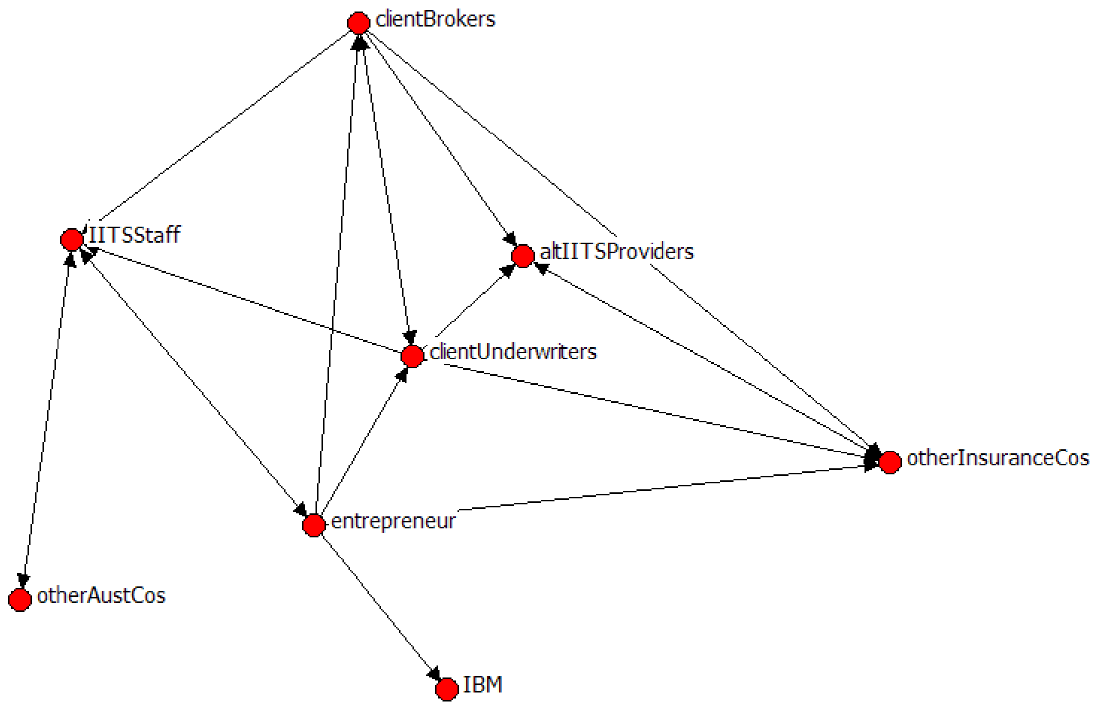
He paid his staff weekly in order to better manage his cash flow. IITS was a cash cow for his yacht repayments, car repayments, house repayments and other personal needs. Everything was a company asset on a lease. IITS maintenance staff washed his cars, did the garden at his house and tended his boat. A cook served hot meals for his lunch daily in the boardroom at work, to which managers were invited and pilloried for their lack of progress.

Instances of cash flow problems include that he once fired 6 out of the 7 clerical accounts' staff on their payday because he could not afford their wages. The telephones were cut off more than once and he had to use his mobile phone to ring out and inquire why. The electricity power was also cut off more than once and IITS incurred a $20,000 bond over 5 years against their electricity bills. An audit that was to last only 6 weeks went on for 15 weeks and he fired IITS accountant for his inability to deal with the auditors. Staff were cheated out of their superannuation money through some clever legitimate ruse, yacht-mooring fees were never paid, and so on.

Money outflows exceeded inflows, so therefore, when one staff member suggested a network with some underwriters, the CEO, eager for money, agreed. He drew up an agreement with that staff member to write the system, in return for a percentage of the profits (because the CEO did not have much money for new development). Ultimately he swindled that staff member and the software was written for next-to-nothing. However the hardware could not be obtanied so cheaply.

In the late-1980s, the owner wooed IBM as a minority shareholder and so his cash flow problems were temporarily eased. However, the old problems recurred. Also, the network had to be expanded and, in order to reach new plateaus, more money was required. This sort of capital expansion typically precipitates cash flow crises. Eventually IBM bowed out of this particular vertical market, but not before the underwriters had experienced the marked benefits to themselves of this network. The underwriters now had the brokers filling in their insurance forms for them, rather than their own clerical staff. The underwriters had cut their own staff and they wanted the network to continue. Therefore they baled out the owner. He tried to keep them at bay and to maintain his own majority shareholding, but while his debts piled up, he sought for but could not find any alternative backers. Eventually the underwriters bought/forced him out.

Figure 3: Phase 1 dependencies.



Major dependency relationships towards the end of Phase 1 are illustrated in Figure 3. The link from the *entrepreneur* to *IBM* indicates the dependence of the former on the latter for funding but, as noted, this relationship was transient. Similarly, the entrepreneur's links to *clientBrokers, clientUnderwriters* and *otherInsuranceCos* designate his dependence on all these parties for much-needed revenue.

The sets of client brokers and underwriters are dependent on each other for their core business. However, once the IITS had been installed, all network participants were now heavily dependent on *IITSStaff* for basic transaction processing (and integrity of same), and these links are shown at the left of the diagram. Similar links to *altIITSProviders* from both brokers and underwriters denote their dependence on alternative providers of insurance IT solutions (in order to avoid being 'locked in' to the one vendor – no matter how high the switching costs).

The *entrepreneur* was also obviously massively dependent on his *IIITStaff* (even if he was apparently unaware of this) but, reciprocally, his staff were dependent on him (for their wages). This was a weak dependence, however, as the IT industry was booming during this period (within Australia and internationally) and the *IITSStaff* could easily find work with other Australian companies *(otherAustCos).* This dependence was mutual, as *otherAustCos* were dependent on the *IITSStaff* (as part of the total Australian IT workforce) for their labour needs. This mutual dependence though was skewed in favour of the IT experts and, as noted, many *IITSStaff* took advantage of opportunities in other organizations (although this was more a consequence of the erratic behaviour of the *entrepreneur* than of the healthy state of the IT industry). Each dependency was assigned a strength in the range, 0-10 (with 10 signifying the maximum value), and these are denoted in the sociogram's underlying adjacency matrix presented in Table 2.

Table 2: Underlying dependency matrix at the end of Phase 1

		1 en	3 cl	2 cl	4 II	5 al	6 ot	7 ot	8 IB
1	entrepreneur	0	10	9	10	0	2	10	10
3	clientUnderwriters	2	0	7	8	8	0	6	0
2	clientBrokers	3	10	0	8	8	0	6	0
4	IITSStaff	6	0	0	0	4	8	0	0
5	altIITSProviders	0	0	0	0	0	0	10	0
6	otherAustCos	0	0	0	7	0	0	0	0
7	otherInsuranceCos	0	0	0	0	6	0	0	0
8	IBM	0	0	0	0	0	0	0	0

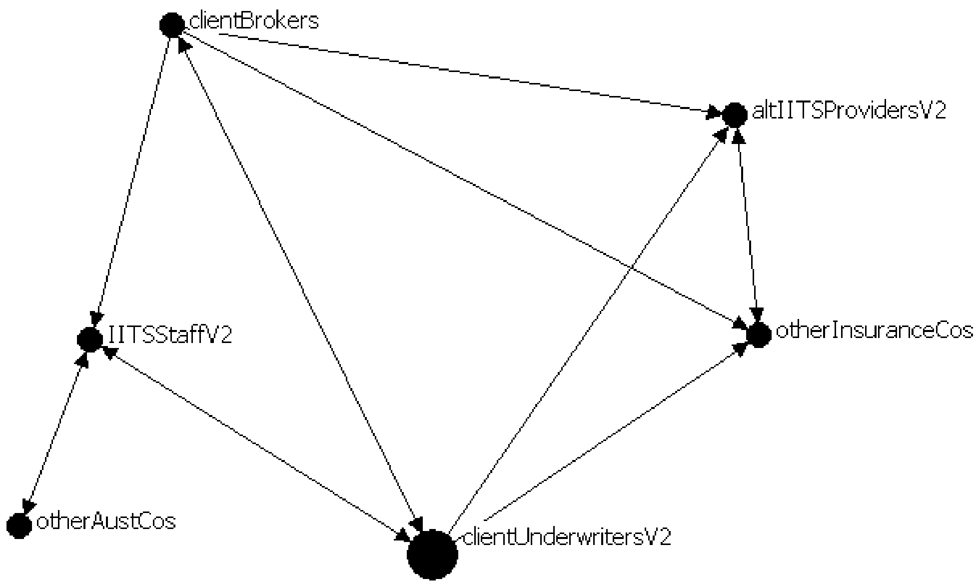
4.3 Phase 2: 1993 – 1995

The new owners were three of the client underwriters and they appointed a new CEO who was an IT specialist, an outsider who had not worked in insurance before. He hired consultants to advise on how IITS might best be developed. His and their combined ideas included: i) having some broker representation on the board of IITS, by having a member of NIBA, (National Insurance Brokers' Association), as an honorary member; ii) despite this, the CEO was of the view that the power balance between underwriters and brokers was unbalanced and decidedly in the brokers' favour; iii) IITS was to become a generalized business software company and to diversify into a series of niche markets, such as manufacturing software, library software, hospitals, taxis, sales, production distribution of any sorts (the consultancy pointed out that IITS already had the core business competencies – these being financial management, client management, document production and electronic transfer of business - and all they had to do was modularize it; and iv) expansion into Asian markets.

One of the shareholding underwriters was also a shareholder in a competitive company, called AIS. The two companies each had three underwriters, with CIC as the common shareholder and CIC was the driving force behind a merger — the two companies merged to form a new company with a new company name and with the five shareholding underwriters as joint owners. The chairman of the combined board was CIC's representative. IITS's CEO was told to manage the IT part of the takeover and conversion of the AIS software, as AIS had an inferior dial-up network.

In an effort to boost IT staff morale and to blend the two companies into one, the CEO brought in yet more consultants. Staff were asked to suggest projects on ways to improve their environment, such as child-minding crèches, a casual-dress day on Fridays, etc. The consultants tied up IITS personnel for days on these initiatives and were heartily disliked by staff. The underwriters also took a dim view of this type of activity, which is hardly surprising because (in the authors' personal experience and observations of insurance companies) it is an extremely conservative industry. Consistent with this, they approach software development and maintenance with the same prudence and adherence to legal matters as they do to with their core business of selling insurance policies and dealing with subsequent claims against these: adventurous they most decidedly are not!

Figure 4: Phase 2 dependencies (high-level).



Dependency relationships at the end of Phase 2 are presented in Figure 4. These are much the same as those in Figure 3, except that:

i) The *entrepreneur* and *IBM* have both been removed from the network;
ii) *clientUnderwritersV2* denotes that the relationships between the underwriters had changed significantly and this actor is represented as a super-node, indicating that it has a substructure (see below);
iii) Similarly, *altIITSProvidersV2* indicates that, with the AIS merger (discussed above), the alternative IITS provider landscape had changed significantly; and
iv) *IITSStaffV2* signifies the amalgamation of the two sets of IITS staff (again, as a result of the AIS merger).

As noted, *clientUnderwritersV2* is a super-node comprised of: i) the *owners,* which may be broken down further into *CIC* and the *otherShareholders;* and ii) the *participantUnderwriters* (non-shareholding underwriters participating in the network). In SNA terms, these parties form a *clique* (a sub-network where all actors are connected to each other). The underlying adjacency matrix at the end of Phase 2 is presented in Table 3, with the derived Figure 4 sociogram formed by *collapsing* the first three (underwriter) rows into their super-node (or SNA *block).*

Table 3: Underlying dependency matrix at the end of Phase 2.

		1 CI	2 ot	3 pa	4 II	5 al	6 ot	7 ot
1	CIC	0	6	6	10	8	0	6
2	otherShareholders	10	0	6	8	8	0	6
3	participantUnderwriters	10	8	0	8	8	0	6
4	IITSStaffV2	0	0	0	0	4	8	0
5	altIITSProvidersV2	0	0	0	0	0	0	10
6	otherAustCos	0	0	0	7	0	0	0
7	otherInsuranceCos	0	0	0	0	6	0	0

4.4 Phase 3: 1996 – 2011

The CEO was quickly removed, and replaced by a CIC staff member who had competently managed their workers' compensation system. His charter was to finally make a profit for the underwriters. Nevertheless, he had little autonomy and all policy decisions were those of the underwriters. Staff had very little say in any decisions and brokers had little also.

Another consultancy (at about $¼ million cost) recommended that IITS focus purely on the network only as its business and to divest itself of its software and hardware operations. As a result, IITS decided:

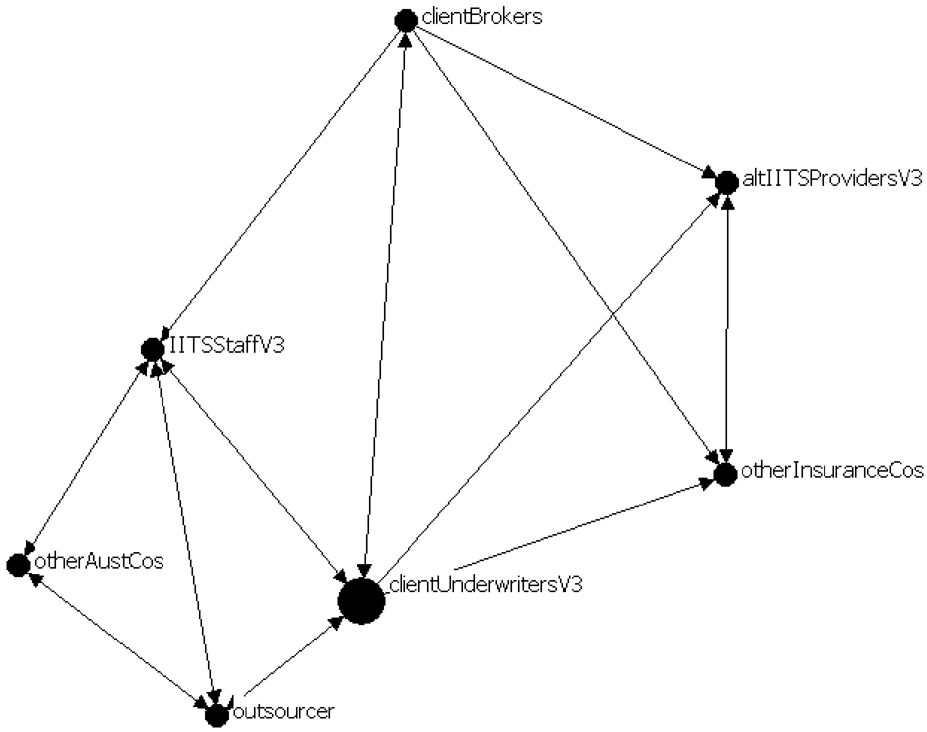
i) To sell off that part of IITS that was making losses – i.e. the brokers' PC and software products;
ii) To focus solely on the more profitable network operations side of the business;
iii) To dismantle the proposed fax gateway in an attempt to lock all brokers more tightly into their network; and
iv) To outsource their software development and maintenance to the maximum extent possible. This initiative was quickly implemented with the result that they have no permanent software programmers remaining and, as such, very little historical knowledge of their software products.

IITS nominated the costs of the millennium bug (year 2000) as one of the major reasons for the outsourcing option. Initially, software operations were outsourced to a Melbourne-based consortium, with some of the underwriters as shareholders in that consortium as well. As a result, the Melbourne consortium now had secured two products; IITS's product with 300 clients and another product (called Pulse) with about 350 clients. The consortium wanted to write a new, bigger and better 'super' product and to thereafter merge these two products into one new product with a client base of 650. They went well over time and budget. They were unaware of the functionality of IITS's software and this has resulted in significant problems (i.e. poor overall productivity and high error rates. They did not even know the database schema of IITS, not even the unique primary keys). The end result was that IITS, as a minor shareholder, had to outlay a great deal more money than would have been required if they had simply undertaken the millennium update in the first place.

Also the underwriters were of the view that the Melbourne consortium was (not unnaturally) seeking to maximise their own profits by making their new product available for any platform — the Melbourne consortium wanted to allow their client base the option of either the internet or the private network (Unilink). Yet again, the underwriters initiated action to secure their own interests in their own private network; specifically, they increased their shareholding in the consortium to 49% and put another nominee of their own on the board. The new board then consisted of five directors, being: one third party nominated from the underwriters, two members from the outsourcer and two from the original consortium (one being the designer of the new product and the other an original financial backer).

The underwriters set tight deadlines, demanded that these be adhered to and injected substantial funds into the consortium in an effort to ensure that this happened. Due to a variety of factors (particularly very poor software engineering and project management practices), this did not happen though. The consortium was then declared to have overspent and to be bankrupt. It was put into the hands of receivers and was bought back by the underwriters via IITS.

Figure 5: Phase 3 dependencies (high-level).



Relationships between the major players towards the end of Phase 3 are illustrated in Figure 5. Significant changes that occurred during this phase included the following:

i) The staff of the original company had evolved to *IITSStaffV3.* All technical system development and maintenance expertise had been outsourced and, while participating brokers and underwriters were still dependent on the original insurance IT broking company (i.e. they still owned the product), the outsourcer was now largely responsible for system and network performance;
ii) Following from i) above, the *outsourcer* had now become a major player in the network;
iii) The underwriters' super-node had evolved to *clientUnderwritersV3.* The composition of this node was much the same as in Phase 2 but CIC was now more dominant than ever; and
iv) The alternative IITS providers situation had evolved to *altIITSProvidersV3,* signifying the establishment of the Melbourne consortium (from existing players), its subsequent demise and, finally, its eventual takeover by the *outsourcer.*

The underlying adjacency matrix at the end of Phase 3 is presented in Table 4.

Table 4: Underlying dependency matrix at the end of Phase 3.

		1 cl	2 cl	3 II	4 ou	5 al	6 ot	7 ot
1	clientUnderwritersV3	0	7	8	10	8	0	6
2	clientBrokers	10	0	8	4	8	0	6
3	IITSStaffV3	6	0	0	10	4	8	0
4	outsourcer	8	2	8	0	0	8	0
5	altIITSProvidersV3	0	0	0	0	0	0	10
6	otherAustCos	0	0	7	7	0	0	0
7	otherInsuranceCos	0	0	0	0	6	0	0

5. Discussion: Evolution of Dependencies

Towards the end of Phase 1, the *entrepreneur* was extremely vulnerable and very dependent on a number of other parties: namely, on the brokers and underwriters for his core business revenue, on the underwriters and IBM for business development income over and above his day-to-day sales and network usage revenue, and on his staff for their expert knowledge, skills and effort. Because of his ownership of the system, he did have some influence with other key players but the balance of power was clearly with the underwriters (in particular). Consequently, when they decided they wanted him out, it was no contest: particularly as his personal 'idiosyncrasies' had left him with little support from other major players (e.g. his staff and the brokers).

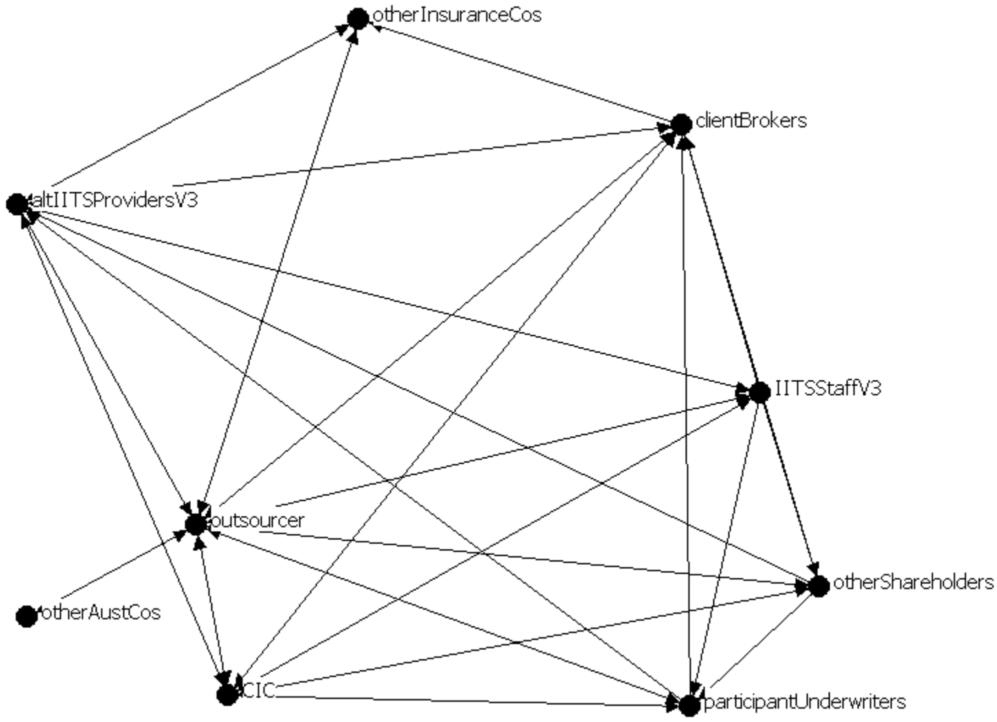
In many respects, the *IITSStaff* had more power than any other party: notably, the *entrepreneur* was heavily reliant on them for the maintenance and day-to-day operation of the system (plus its further development), and the brokers and underwriters needed them to maintain the system, to provide them with information on its use and to fix problems when they occurred. Perhaps, less obviously, the staff also wielded influence because their expert knowledge meant that they necessarily had to be involved in strategic decision making processes. It may have been this access to the underwriters that ultimately led to the original owner's demise (given that it is hard to imagine key staff passing on a positive view of their boss).

During Phase 2 there was a significant change in the balance of power between the client underwriters. This is apparent in Table 3 where as previously noted, while the parties that make up the *clientUnderwritersV2* super-node form a clique, the dependency relationships are unbalanced: specifically, the *otherShareholders* and *particpantUnderwriters* are clearly more dependent on *CIC* than the reverse. Mostly, this was because of *CIC's* position as the major shareholder in the combined company entity that resulted from the AIS merger and its power was evident from its role in events that occurred during this phase: namely, it was the driving force behind the merger and the CEO of the new company was its nominee.

The major change that occurred during Phase 3 was the outsourcing of the system and this resulted in a major power shift from the *clientUnderwriters* and the *IITSStaff* to the *outsourcer* (see Table 4). This is hardly surprising as the loss of critical knowledge that occurs when companies choose to outsource their IT operations, coupled with the consequent heavy dependence on the outsourcer that also results, is a phenomenon that has been well-documented in the outsourcing literature (see e.g. Lacity and Willcocks, 2000). A quick glance at Figure 1 makes this readily apparent as, once outsourcing has occurred, it is the outsourcer that now: has the expert knowledge derived from system development and maintenance; is in control of important information provision processes; has to be consulted during decision making activities; and has ultimate control over the provision of scarce resources (particularly expert knowledge, skills and the individuals that possess these).

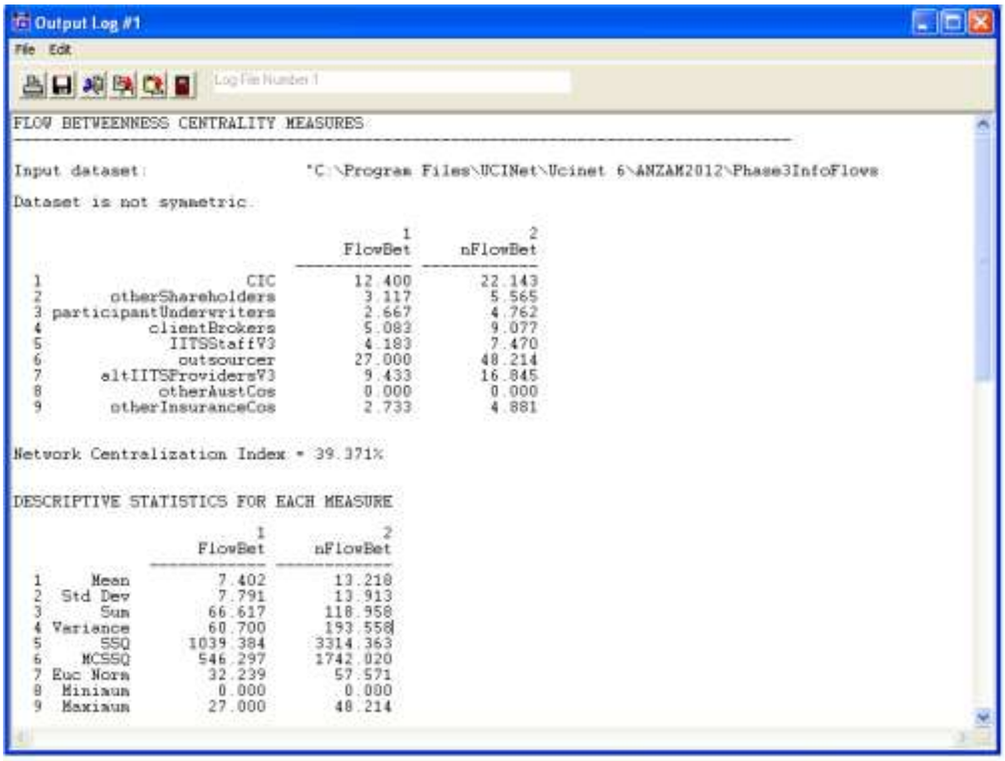
To this point, we have represented dependency relationships employing sociograms and their underlying adjacency matrices. As noted earlier, this allows much useful analysis to be undertaken using standard and well-established SNA algorithms – such as those employed in *UCINet.* For example, the network of information flows among stakeholders (with the underwriters' super-node expanded) nearing the end of Phase 3 is illustrated in Figure 6. In terms of power derived from communication network centrality, this sociogram is certainly of interest (e.g. *CIC* and the *outsourcer* are obviously key players) but, even with only nine actors, it is difficult to discern much from what is already a fairly complex graph.

Figure 6: Phase 3 information flow network.



As an alternative, we can analyse the underlying adjacency matrix using *UCINet's flow betweenness* algorithm, with the output presented in Figure 7. This clearly indicates that *CIC* and the *outsourcer* are much more central to information flows than any of the other parties. With this particular algorithm, the measure calculated provides an indication of how involved each actor is in *all* flows between other pairs of actors in the network. A high value indicates that an actor has many alternatives to reach other actors and, hence, it is unlikely that a 'reluctant broker' will be able to prevent desired communication (or receipt of important information). This particular algorithm is only one of a suite of *UCINet* centrality techniques, each of which is concerned with power and influence derived from particular types of control over information flows.

Figure 7: A *UCINet* communications network centrality analysis (for Figure 6).



Output Log #1

File Edit

Log File Number 1

FLOW BETWEENNESS CENTRALITY MEASURES

Input dataset: "C:\Program Files\UCINet\Ucinet 6\ANZAM2012\Phase3InfoFlows

Dataset is not symmetric.

		1 FlowBet	2 nFlowBet
1	CIC	12.400	22.143
2	otherShareholders	3.117	5.565
3	participantUnderwriters	2.667	4.762
4	clientBrokers	5.083	9.077
5	IITSStaffV3	4.183	7.470
6	outsourcer	27.000	48.214
7	altIITSProvidersV3	9.433	16.845
8	otherAustCos	0.000	0.000
9	otherInsuranceCos	2.733	4.881

Network Centralization Index = 39.371%

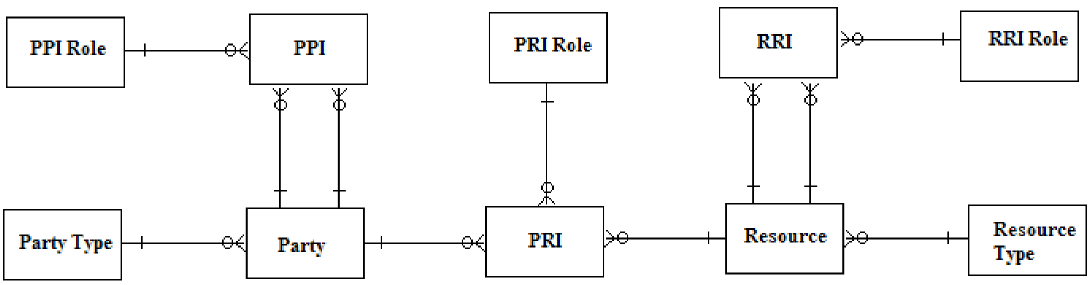
DESCRIPTIVE STATISTICS FOR EACH MEASURE

		1 FlowBet	2 nFlowBet
1	Mean	7.402	13.218
2	Std Dev	7.791	13.913
3	Sum	66.617	118.958
4	Variance	60.700	193.558
5	SSQ	1039.384	3314.363
6	MCSSQ	546.297	1742.020
7	Euc Norm	32.239	57.571
8	Minimum	0.000	0.000
9	Maximum	27.000	48.214

However, it is our contention that power, influence and dependency relationships may also be usefully specified using the representation formalisms employed by McGrath (1994) in his *MP/L1* model: specifically, as an entity-relationship (E-R) model (Chen, 1976) surrounded by rules expressed in 1st-order logic (Kowalski, 1979). The E-R component is presented in Figure 8. Entity types in the diagram represent relations and these are linked together in the rules component of the model to produce derived relations.

The E-R model is highly abstracted and is based on the *REA (resources, events* and *agents)* framework of McCarthy (1982). As noted by Dampney, Johnson and Deuble (1993), a difficulty of the generalized approach is that much of a model's meaning must necessarily be hidden in its detail. This is true of our representation, where the semantics of models must be gleaned from an examination of populated relations. On the other hand, generalization means that the generic model can be conveniently customized for different domains and instances and that coding is substantially reduced (because advantage is taken of commonality).

Figure 8: Dependency model – E-R component



Each of the boxes in Figure 8 represents an entity or relationship that may be implemented as a relational table. For example, *rri (resource-resource involvement)* in Figure 9 is an *Access™* representation of the relationships between the power sourcesillustrated in Figure 1. The *rriRole* employed here is *subtype,* so *informationProvision* is a subtype of *decisionMaking, expertKnowledge* is, in turn, a subtype of *informationProvision* etc. The other table in Figure 9, *pri (party-resource involvement),* details parties that have power because of roles they are involved in with various resources, with *priRole* signifying the specific involvement role. Thus, *CIC* has power because it owns the *IITS* system, the same applies to the *otherShareholders* and the *outsourcer* derives power through its roles in developing and maintaining the same system.

Figure 9: Populated *rri* and *pri* tables (partial).

rri : Table

ID	r1	r2	rriRole
1	power	deepStructurePower	subtype
2	power	surfaceLevelPower	subtype
3	surfaceLevelPower	decisionMaking	subtype
4	decisionMaking	informationProvision	subtype
5	informationProvision	expertKnowledge	subtype
6	expertKnowledge	development	subtype
7	expertKnowledge	maintenance	subtype
8	informationProvision	ownership	subtype
9	surfaceLevelPower	resourceProvision	subtype
10	resourceProvision	expertKnowledge	subtype
11	resourceProvision	ownership	subtype
(AutoNumber)			

pri : Table

ID	party	resource	priRole
1	CIC	ownership	ISInvolvement
2	otherShareholders	ownership	ISInvolvement
3	outsourcer	development	ISInvolvement
4	outsourcer	maintenance	ISInvolvement
(AutoNumber)			

Within the base relational *pri* table, it is only necessary to specify party-resource involvements at the lowest level. Links between power sources can then be derived using the recursive procedures (represented in quasi-*Prolog):*

> *Resource_2 isaSubtypeOf Resource_1* ***if***
> *rri(RRIId, Resource_1, Resource_2, subtype).*

> *Resource_2 isaSubtypeOf Resource_1* ***if***
> *rri(RRIId, Resource_1, Resource_3, subtype)* ***and***
> *Resource_2 isaSubtypeOf Resource_3.*

Then, combined with the following procedures:

> *Party derivesPowerFrom Resource* ***if***
> *pri(PRIId, Party, Resource, PRIRole)* ***and***
> *Resource typeIs powerSource.*

Party derivesPowerFrom Resource ***if***
Resource_1 isaSubtypeOf Resource ***and***
Party derivesPowerFrom Resource_1.

employing these procedures, all types of power that parties have through their various involvements in information systems may be inferred. Furthermore, this almost invariably means that other organizational actors will be dependent on those parties.

6. Conclusion

In analysing organization life and decision making, the power model is often appropriate where there is incomplete information, uncertainty, scarce resources and competing perspectives on how particular issues should be viewed. All these are characteristic of much IS activity (Markus, 1983). In this paper, the fundamental power model concept of stakeholder dependencies was employed as the framework to investigate a case study centred on an Australian insurance industry IS and, as such, our study adds to the substantial body of literature which has employed the power-political frame to investigate, explain and understand IS development, implementation and operation.

SNA methods were used to specify, depict and analyse the dynamics of stakeholder dependencies during the life of the system. In doing so, a longitudinal view of the evolution of these dependencies was taken and, as such, the approach adopted represents the beginnings of the development of a more dynamic approach to SNA. An alternative analysis approach was also suggested with the aim of providing a tool that could enable a change agent to conduct a rigorous and systematic search for potential resistance based on threats to stakeholder power sources. This is consistent with Mackenzie (1986), who proposed a similar model based on a 'structured cascading of uncertainty and dependency'. He argued that, unless links between organization parties, processes and resources are first established, a change agent will face considerable difficulty in assessing the potential impact of any initiative. Similarly, in the approach 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 organization actors will jealously guard some power sources, yet be relatively unconcerned about others (Pfeffer, 1981). Knowledge of these factors is essential if a change agent is to choose appropriate tactics. Finally, with regard to the broad research question presented in Section 3, the study has revealed that an analysis of power sources and dependencies do, indeed, provide a useful framework through which IS evolution can be understood.

A limitation of our study is that the particular events that led to the evolution of the SNA dependency networks presented, while described in some detail in the text, have not been formally modelled. We believe that agent-based technologies (Borschev and Filippov, 2004) might well be used to good effect here and we have identified this as an extremely promising area for further research.

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