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DISTRIBUTED NEGOTIATION SUPPORT SYSTEMS

– Metagame Analysis Approach –

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Abstract

Decision support oriented NSS(Negotiation Support System) based on metagame analysis has been developed. One of characteristics of the system is that a negotiator himself can use the system to improve negotiation and he is able to get information on the possibility of coalition with other negotiators in the problem. In order to implement those facilities, the system has been realized as a distributed system in C/S(Client/Server) architecture.

1 Introduction

One of research fields in DSS is on GDSS(Group Decision Support System). A lot of researches on GDSS are found in the 80's. Most of them are on EM(Electronic Meeting), that is, to support group members to have a group decision at a meeting room[Nunamaker et al., 1989].

NSS(Negotiation Support Systems) can be considered as a branch of GDSS. A list of NSS is found in the reference[Jellasi et al., 1989]. According to the list, metagame analysis is one of fundamental theories in NSS field. One of well-known NSS based on metagame analysis is CONAN[Howard, 1987]. It is an NSS with which a consultant uses to make an advice for a negotiator. There may exist two types of gulfs in interaction in this kind of NSS. One is between a negotiator and a consultant and the other is between the consultant and the system. It is necessary to get across the gulfs to support negotiators.

The goal of this research is to design and implement NSS in order to do it. We intend to design and implement an NSS with which a negotiator himself uses to solve his problem.

Firstly, we briefly explain metagame analysis on which our system is based. Secondly, we state the specification of the system based on consideration on CONAN system. Thirdly we describe the developed NSS with which a negotiator himself uses to solve a problem. In order to satisfy another requirement, we modified the system in Client/Server(C/S) architecture and con-

structed a prototype. We briefly state on the benefits of NSS in C/S architecture.

2 NSS based on metagame analysis

In negotiation, there is a negotiator who confronts with the negotiation problem. Let us call him/her as an actor. Each actor has several alternatives called options. A combination of options taken by an actor is called a strategy. Then a combination of strategies by each actor corresponds to a problematic situation called a scenario. Generally, we represent a situation as a vector consists of 0 and 1, where 1 denotes that the option is selected and 0 otherwise.

Let us illustrate metagame analysis with an example of the problem on Major League[Tsuda, 1995].

Example 1 Major League problem

In Major League, free agent system and agent system cause to increase baseball players' salary and many baseball teams fell into deficit finance. Finally, negotiation between capital and labour was broken off last year and baseball players went on strike. And owners stopped the baseball season in the middle of last August.

In this situation, actors are owners, agents and baseball players. Simply speaking, owners has three options, to raise player's minimum salary, to dismiss all major players or to stop the baseball season. Agents has an option to accept the salary cap. While baseball players has an option to go on strike (Table 1).

Since a scenario is a vector of 0 and 1 with respect to selection of those options, there are following feasible scenarios in this problem as shown in Table 2.

According to the preference on scenarios for each actor, we will have a scenario space and we can analyze stability of a target scenario. In this problem, preference on scenarios for each actor may be given as follows,

owners	4 > 1 > 5 > 2 > 3
agents	3 > 1 > 2 > 5 > 4
baseball players	3 > 1 > 2 > 4 > 5

Table 1: Options in Major League problem

ACTORS	OPTIONS
OWNER	raise player's minimum salary dismiss all major players stop the baseball season
AGENT PLAYERS	accept the salary cap strike

Table 2: Scenarios in Major League problem

ACTORS	OPTIONS	scenarios				
		1	2	3	4	5
OWNER	raise player's minimum salary	0	1	1	0	0
	dismiss all major players	0	0	0	0	1
	stop the baseball season	1	0	0	0	1
AGENT PLAYERS	accept the salary cap	0	1	0	1	0
	strike	1	0	0	0	1

For example, owners is considered to prefer scenario no.4 to scenario no.1. Then we have a figure called a strategic map (Figure 1)

In this map, arrows represent unilateral improvements and dotted-line arrows represent sanctions by which the improvements may be deterred.

Those three concepts of actors, options and scenarios are fundamental terms in metagame analysis.

One of well-known NSS based on metagame analysis is CONAN. From the viewpoint of decision support, there are following points in CONAN.

1. It is expected to be used by a consultant to give an advice for a negotiator. That is, it is not easy to use the system for a negotiator himself if he is not familiar with metagame analysis.
2. Therefore there is no standard facilities as DSS such as what-if, sensitivity and goal-seeking analysis.
3. It is a tedious task for a user to order scenarios according to the negotiator's preference.
4. There is no considerations on coalitions among negotiators.

Based on the above consideration, the target NSS in our research is required to satisfy the following conditions.

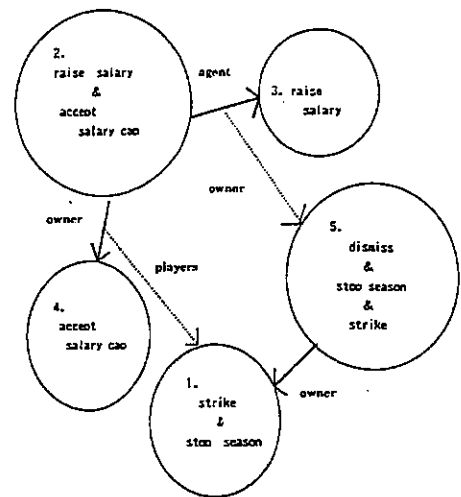


Figure 1: Strategic Map in Major League Problem

1. It must be used by a negotiator himself and support his negotiation more actively.
2. It should release a negotiator from the tedious task to order scenarios.
3. It will suggest a coalition for negotiators based on their preference ordering on options.

Though it is needless to say that the system should be user friendly so that a negotiator can easily use, it is not a main target in this research.

3 NSS as DSS

In order to meet the first requirement, we have implemented the first version of NSS based on metagame analysis that has several facilities for decision aids such as what-if, sensitivity and goal-seeking analysis. This version of the system is called metaop1[Doi, 1994]. The usage of metaop1 is shown in the flowchart in Figure.2

It is not necessary to use the system to be familiar with metagame analysis. And a negotiator himself can analyze stability of scenarios by using facilities of decision aids in the system. In this sense, the system satisfies our first requirement.

In order to satisfy the second requirement, it is expected to decrease numbers of comparison among scenarios if we can order scenarios based on preference on options[Hipel et al, 1994]. We have proved that it is true[Tsuda, 1995] and therefore it is meaningful to

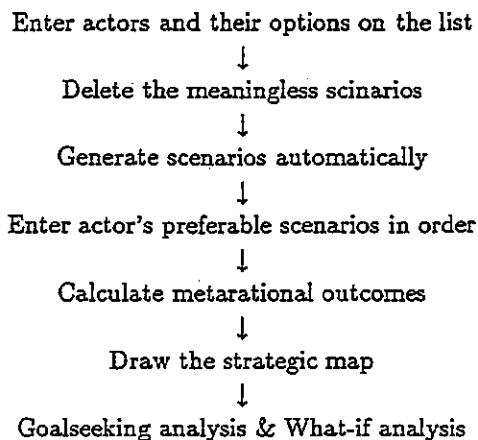


Figure 2: Flowchart in Metaop1

adopt this approach. The second version of the system is implemented to meet the requirement.

In order to satisfy the third requirement, it is necessary for the system to be used by each negotiator in the problematic situation. Therefore we adopt Client/Server architecture and modify the system in the architecture.

There are several reasons for it. One of them is that it depends on users what sort of interfaces is appropriate for him. Since the system is supposed to be used by negotiators, it is better if he can customize the interface. Another reason is that it will be possible to separate functions of the system for clients and server so that the global information including negotiator's preference can be handled in server.

General policy of separating functions of a system into client and server is that it will be placed on server if it is public and on client if it is private. According to the policy, we can separate functions of the system as follows.

CLIENT	<ul style="list-style-type: none"> • user input on options • user input on preference on options • output strategic maps for users • suggestion of coalitions for users
SERVER	<ul style="list-style-type: none"> • construct preference orderings on scenarios • calculation of distance between preference orderings • analysis of stability of solutions

We have implemented a prototype of the system in C/S architecture. In this prototype, communication between clients-server is implemented with TCP/IP and it is through socket mechanism to exchange messages.

Now, the system is going to be implemented in UNIX-WINDOWS environment.

4 Conclusions

In this paper, firstly, we gave a brief review on metagame analysis. Then we consider the points of CO-NAN, which is a representative NSS based on metagame analysis, from the viewpoints of decision support. Then we discuss on the requirements of NSS and we have implemented NSS based on metagame analysis that can be used by a negotiator himself in order to meet the requirements. The present system is implemented in C/S architecture on UNIX and it will be implemented in UNIX-WINDOWS environment in near future.

References

- [1] T.Doi, "Implementation of Decision Support in Negotiation" (in Japanese), bachelor thesis, Dept. Industrial Management and Systems Engineering, Tokyo Institute of Technology, 1994.
- [2] K.W.Hipel and D.B.Meister, "Conflict analysis methodology for modelling coalitions in multilateral negotiations", *Information and Decision Technologies*, Vol.19, No.2, 85-103, 1994.
- [3] N.Howard, "The present and future of metagame analysis", *European Journal of Operational Research*, Vol.32, pp.1-pp.25, 1987.
- [4] M.T.Jelassi and A.Foroughi, "Negotiation Support Systems : An Overview of Design Issues and Existing Software", *Int. J. DSS*, Vol.5, pp.167-pp.181, 1989.
- [5] J.F.Nunamaker, Jr., "Experience with and Future Challenges in GDSS:Preface", *Int.J. DSS*, Vol.5, pp.115-pp.118, 1989.
- [6] T.Tsuda, "Negotiation Support Systems based on Metagame Analysis" (in Japanese), bachelor thesis, Dept. Industrial Management and Systems Engineering, Tokyo Institute of Technology, 1995.

AN ASSESSMENT OF A CENTRALISED IT POLICY MAKING BODY BASED ON FORWARD AND BACKWARD MAPPING

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This paper looks at the role of an information technology policy-making body in an Australian state government and the fulfilment of that role in relation to Elmore's concepts of forward and backward mapping. These concepts help explain the development, roles and demise of this body over fifteen years, explaining the continuing debates about the appropriate level of centralisation of decision making and control exercised by a centralised body.

Elmore's (1979) concept of forward mapping emphasises the separation of planning and implementation of policies, with policy planners maintaining control over implementation while the concept of backward mapping implies that policy planning and implementation cannot be separated and that in reality the policy-making process starts with ideas concerning specific actions to general policy plans. These concepts provide a useful framework by which to describe and analyse the case study.

1 Introduction

Centralised computing bodies in large organisations are generally discussed in the information technology (IT) management literature in terms of the efficiency and effectiveness of the IT management function. The concepts of forward and backward mapping, used in implementation analysis, form another framework for discussing the role of such bodies and this paper looks at them in relation to a policy making body in an Australian state public service. In this paper, the concepts are used purely as a tool for describing the activities of this body. As far as can be ascertained, they have not been used explicitly in the state service before. The problems encountered by this centralised body and the ongoing nature of the debate concerning the degree of centralisation required in IT policy formation reflects a general debate as to the best approach for policy implementation which the concepts of forward and backward mapping reflect.

The Computer Policy (Advisory) Committee was a centralised policy making body in the Tasmanian State Service from the late seventies until the late eighties. In its early years, it attempted to tightly control the development of a centralist computing infrastructure in the state service. After an overhaul in the early eighties, the committee intended to change its emphasis to coordination rather than control but in its actions it still attempted to control computing in the service by evaluating agencies' compulsory electronic data processing (EDP) plans. Changes in the organisational and technological environment promoted a greater devolution of authority which led to the demise of the committee in the late eighties. In the early nineties, there was a

growing concern that the full advantages of IT implementation were not being realised in the service and in late 1993 an Information Strategy Unit (ISU) was established to fulfil a perceived need for a centralised body to aid IT management issues.

Considering the development, roles and demise of the committee in relation to the concepts of forward and backward mapping, four main eras can be identified. In the early years, the committee took a strict forward mapping perspective but after the overhaul in the early eighties, some of the ideas of backward mapping were expressed before the forward mapping perspective again became dominant. As general government policies and technological trends promoted a more backward mapping philosophy in the service during the eighties, the committee became increasingly isolated and redundant. With the demise of the committee in the late eighties, the problems of forward mapping were implicitly recognised but no suitable alternative was developed, leading to the development of a new centralised IT management body.

2 Forward And Backward Mapping

Elmore (1979) identified forward and backward mapping as two separate approaches to analysing the implementation of policy. Although directed primarily towards the implementation of public policy, the concepts are also applicable to the implementation of policies within an organisation. Forward mapping is also termed the 'top-bottom approach', the 'policy-centred approach' and the 'policy-maker's perspective' (Younis and Davidson 1990), but Elmore's terms will be used in this paper. The ideas of top-down/ bottom-up policy implementation are discussed in more detail in section 4.3.2.

2.1 Forward Mapping

Forward mapping, wrote Elmore, "is the strategy that most readily comes to mind when one thinks about how a policy-maker might try and affect the implementation process" (Elmore 1979). Beginning with a clear statement of the policy-maker's intent, forward mapping progresses through a series of increasingly specific steps. The logic of such an approach is that it begins with an objective and a stated outcome, against which success can be measured (Ibid, p 603). It assumes that policy-makers have control over the organisational factors that affect implementation. Elmore believed that this is how most policy analysis, management science and decision analysis are treated in the literature and is the approach reflected in many management tools, such as the critical path method and PERT diagrams. Formal strategic planning could also be included in this paradigm as it implicitly assumes that planning

and decision-making can be separated from their implementation.

2.2 Backward Mapping

Backward mapping can be likened to a "bottom-up" approach to policy implementation (Younis and Davidson 1990), the logic being the opposite to that of forward mapping. Elmore describes it as beginning

'...not at the top of the implementation process but at... the point where administrative actions intersect private choices. It begins not with a statement of intent, but with a statement of the specific behaviour at the lowest level of the implementation process that generates the need for a policy. Only after that behavior is described does the analysis presume to state an objective; the objective is first stated as a set of organisational operations and then as a set of effects, or outcomes, that will result from these operations' (Elmore 1979, p 604).

In essence, the backward mapping approach tackles the issues of implementation before and while policy is being created and it is only at the final stage that the policy-maker makes a policy which directs resources.

Unlike forward mapping, backward mapping does not rely on compliance with the policy-makers intent as the standard for success (p 604). Forward mapping assumes that the implementation process is linked in an hierarchical relationship, with the source of policy being the area with most authority and influence. Success is achieved with clear lines of authority and control. In contrast to this, backward mapping assumes that it is easier to influence policy the closer one is to the problem. Implementation success is not seen to be a result of control and authority, but discretion at the face of the problem.

Elmore states that applying forward and backward mapping to the same problem gives different results. The former tends to emphasise centralised control and factors that are easier to manipulate by policy-makers, such as funding, organisational structures, authority relationships and regulations. Backward mapping tends to stress the dispersal of control with related factors such as incentive structures, the ability and knowledge of people near the problem, the bargaining relations among different levels of the organisations and the strategic use of funds. The former sees policy implementation as an hierarchically ordered process; the other, as a decentralised process (p 605).

2.3 Information Technology Policy Implementation and Centralised Bodies

Centralised policy making bodies in large organisations could be considered as tools for implementing policies. Their creation is generally discussed and rationalised in the IT management literature in terms of the efficiency and effectiveness of the overall IT management function in the organisation from a forward mapping perspective. Brussard, for example, stated that,

'A key question is: What degree of autonomy has or can have each government organisation in the field of IRM. It lies in

the essence of information that it should be exchanged within and between organisational and administrative units. Autonomy can therefore never be absolute. The constraints are partly of a technical and economic nature and for that reason are in a constant state of flux (improving price/performance ratios). Also of importance is the division of responsibilities which may have been established over the course of time or been laid down by statute, and the resulting vested interests in terms of budget size, number of staff, personal career expectations, etc' (Brussard, 1988, p 90).

The emphasis on the division of responsibilities and the level of autonomy suggests Brussard has taken a forward mapping perspective to policy implementation. If he were taking a backward mapping perspective, he would be discussing how to give each agency responsibility for their own actions and the resources to carry through their decisions.

As stated before, the formal strategic planning process implies a forward mapping perspective and, in many cases, the word "strategies" can be used in the IT literature in the same sense that "policy making" is used in public sector literature. For example, Lorsch described strategies as

'... a stream of decisions taken over time by top managers which, when understood as a whole, reveal the goals they are seeking, and the means used to reach these goals' (Lorsch, 1986, p 95).

Similarly, in the literature on policy making, Hogwood and Gunn state that a policy statement '...expresses the broad purposes (or 'ends') of governmental activity in one field and also describes the state of affairs which would prevail on achievement of those purposes' (Hogwood & Gunn, 1984, p 14).

In the IT management literature, Ward et al (1990) refer to Porter's (1983) strategies for the information systems (IS) strategic planning process. Porter believed that strategies could be centrally planned, leading edge, freemarket, monopoly, scarce resource or a necessary evil (Ward et al, 1990, pp 251-255).

These terms can be related to forward and backward mapping. Backward mapping involves little policy creation or implementation and so reflects neither perspective but most of the others implicitly reflect a forward mapping perspective. Centrally planned strategies are created by a "centralised senior dedicated agency" (p 251) and so strategy reflects a forward mapping perspective. The monopoly and scarce resource strategies are also in the forward mapping paradigm as the former involves the control of IT implementation actions by a central body while the latter implies the control by a central body through checks on expenditure. Leading edge strategies are forward mapping strategies as, even though it is committed to entrepreneurship, this innovation is centred on R&D departments. Only the free market strategy implies a backward mapping philosophy by placing responsibility for IT developments firmly with users and user management.

Ward et al believed that IT planning is progressing through three stages of development. They associated scarce resource or freemarket strategies with an early era, called data processing, in which information technology was simply used to automate existing processes. They termed the era when people realised they could gain further information from information systems the management information systems (MIS) era. They stated that this era is characterised by monopoly strategies. In the mature strategic information systems (SIS) era, IT is used to give organisations sustained competitive advantage by underwriting changes in organisations' structures and processes. In this era, Ward et al believed that a centralised policy is dominant, with some freemarket and leading edge strategies. Formal IT strategies are closely linked to general business strategies, placing the IS planning process firmly in the forward mapping paradigm.

The forward mapping perspective has also been dominant amongst policy makers in Australian governments. In 1987 the Eighteenth States Computer Conference in Australia concluded that there was a need for a central agency to oversee government computing developments. The roles of such an agency included:

- the co-ordination of policies and guidelines for interagency (and sometimes) intra-agency issues;
- to be a source of independent advice;
- to be a service agency determined by market forces (including consulting);
- policy should be separate from service;
- policy group should set standards...;
- policy group must have at disposal resources of operations group;
- policy group must have cross fertilisation from different agencies. It should be manned by seconded staff;
- improve the planning and effective use of information within the agencies (Minutes of the 18th State Computer Conference, 1987)

The conference recognised some of the principles of backward mapping but still remained committed to the forward mapping paradigm. It concluded that the above could be achieved by identifying a patron in the higher management levels of government and by selling information management as cost effective and to marketing the capabilities of information technology, suggesting a forward mapping perspective. By recognising the need to employ people who could sell their ideas, the conference participants recognised that those at the "shopfront" level could influence the success of a policy's implementation. However, by placing the emphasis on "selling" policy rather than consulting, it is clear the emphasis was still on the outward flow of information and policies. That is, they implicitly took a forward mapping perspective. By stating it was necessary to sell the policy, the conference participants recognised some of the shortcomings of forward mapping, but still seemed committed to this approach.

2.4 Problems with Forward Mapping

Elmore's 1979 article is primarily a criticism of the forward mapping approach. He believed that while forward mapping is used prescriptively, it does not adequately describe what happens in organisations.

'The most serious problem with forward mapping is its implicit and unquestioned assumption that *policy-makers control the organizational, political, and technological processes that affect implementation*. The notion that policy-makers exercise- or ought to exercise- some kind of direct and determinant control over policy implementation might be called the "noble lie" of conventional public administration and policy analysis... Policy analysts justify their existence by arguing that informed, rational choices by policy-makers are necessary to guide and control administrators. Neither administrators nor policy analysts are very comfortable with the possibility that most of what happens in the implementation process cannot be explained by the intentions and directions of policy-makers' (Elmore, 1979, p 603).

Forward mapping, he continued, assumes that implementation will be improved by more explicit policy directives, better attention to administrative responsibilities and clearer statements of intended action. In pursuing these actions, the paradigm reinforces what Elmore calls the "myth" that implementation is controlled from the top. He also criticised this approach for only considering a narrow range of reasons for implementation failure, producing standardised solutions which he believed are "notoriously unreliable" (p 610) and difficult to adapt and for not considering the benefits of discretion when implementing policy.

As Elmore points out, however, the main reason for forward mapping is the lack of a suitable alternative for analysing policy implementation. He introduces the idea of backward mapping as a possible alternative. However, as the IT management literature has recognised and the case study described in this paper illustrates, there are also problems with this latter approach.

Elmore states that policy makers tend to perceive complex organisations as barriers to the implementation of policy, not as instruments. A centralised body for creating information technology policy could be considered in both ways and the remainder of this paper discusses the development, roles and demise of such a body in relation to forward and backward mapping.

3. History of Information Technology Policy Bodies in the Tasmanian State Service

During the 1980s the Tasmanian State Service undertook a major investment in information technology, induced by rapid advances in technology and the economic necessities of achieving greater efficiencies in its operations through appropriate use of information systems. Since 1966 there have been attempts to enforce centralised control over the development of information systems to ensure the

co-ordination of computing resources and the improvement of the standard of information technology across the service.

Some states, such as Western Australia, created a separate department responsible for information technology (Hargraves 1986) but in Tasmania central administrative control of computing has been more dispersed amongst a number of bodies. These have included the Computer Policy (Advisory) Committee, the Audit Department/Office, the Department of Treasury and Finance, intra-agency management controls and facilities centres, such as the State Computing Centre/TASCIT. This paper concentrates on the role of the Computer Policy (Advisory) Committee,

This section will provide an historic overview of the development and actions of the committee. The material was gathered from interviews with employees of the Tasmanian State Service, documentation such as annual reports and correspondence and a masters thesis written by M Hargraves, the secretary of CPAC, in 1986.

Considering the development of the committee in relation to forward and backward mapping, four main eras can be identified. In the early years, the committee took a strict forward mapping perspective but after an overhaul in the early eighties, some ideas consistent with a backward mapping approach were expressed before the forward mapping perspective again became dominant. As general government policies and technological trends promoted a philosophy reflecting backward mapping principles, the committee became increasingly isolated and redundant during the eighties. With the demise of the committee in the late eighties, the problems of a forward mapping style were recognised but no suitable alternative was developed, leading to the development of a new centralised IT management body.

3.1 The Initiation of a Centralised Body to Oversee the Development of Mainframe-Based Computing

The original Computer Policy Committee (CPC) tightly controlled the introduction of computer systems in an attempt to establish a service-wide computer system centred around a State Computer Centre (SCC) in the late seventies and early eighties, reflecting the tacit dominance of a forward mapping perspective. The SCC was intended to provide a central bureau service for most of the state service, the mainframe technology of the time and uncertainty about the future of information technology promoted the creation of a centralised IT body (Hargraves 1986). The CPC was established in 1975 to oversee the centre's development. Until the new centre was established, the CPC was to have control over agencies' computer purchases and the committee discouraged the development of independent departmental systems.

There were, however, delays in establishing the new centre, primarily because the government had difficulty deciding what would be the best course to take on such issues as the site of the new section and funding for the necessary equipment. The CPC was seen by many of its clients in the agencies as a constraint on the development of new technology to

aid the administrative tasks required by the government. While the SCC was being established, several other computer facility centres emerged. Forestry, the Hydro Electric Commission, the Transport Commission and the Department of Education had developed their own computer systems and did not intend to utilise the new State Computer Centre.

When the new SCC began operations in 1980, the CPC was retained to oversee computing across the whole state service. With the establishment of several computer centres, it was believed a central body was required to oversee them and co-ordinate computing across the state service. Although a trend towards distributed systems was beginning, spurred on by lower hardware costs, this co-ordination centred around existing centralised mainframe facilities as it was believed that some rationalisation of resources could be achieved if agencies could be made to share computing facilities and the CPC allowed IT systems to be developed if they used the resources of one of the existing facilities (Hargraves 1986). The emphasis on the centralised control of decision making is consistent with an underlying forward mapping perspective.

There was a reaction against the centralised control of policy generation of the CPC which may be interpreted as a forward mapping orientation. This was spurred on by changing technology. The CPC's authority became undermined as it came to be seen as a constraint on the development of IT systems. Such centralised computer policy creation may have been understandable at the time as investing in computer systems was a large and reasonably risky decision (Hargraves 1986). However, in following such a centralist policy, the CPC became increasingly unpopular with people in the agencies in the late 1970s who realised the possible benefits of the newly available distributed systems and less expensive hardware while the SCC and the CPC were still committed to mainframe technology. Decisions concerning even minor IT matters were made by the committee in an attempt to enforce standardisation and improve the quality of IT across the service.

3.2 The Overhaul of the CPC

By 1980 there was much criticism of the CPC and an inter-departmental task force was established to advise Cabinet about the management of computer facilities in the service. At the recommendation of this task force, the CPC was revamped.

The *Annual Report of the Auditor General 1980/1981* heralded the formation of the new Computer Policy Committee:

In April 1981 the Government announced the establishment of a new Computer Policy Committee whose functions, inter alia, are to co-ordinate and maintain a general oversight of the use of computing and associated automatic data processing facilities throughout the Tasmanian Government Service, including Public Service Departments, Instrumentalities, Authorities and Agencies of the Crown' (Auditor General's Department, 1980/1981, p 10).

The new CPC's terms of reference were drawn up primarily by representatives of the departments in reaction to the inadequacies perceived in the strictly centralised control of the previous CPC (Ibid) and so at least are partially consistent with a backward mapping perspective. In its first annual report, the new committee emphasised that it was concerned with 'co-ordination rather than control' of computer systems in the State Service. The agencies would hold primary responsibility over their computer installations, the new CPC acknowledging that:

'..Public Service Management must decide on the ends, with computer specialists available to advise on the means' (Public Service Board, 1981-1982, p 8).

Membership was to be drawn from Agencies and it was planned that it would include computer specialists as well as bureaucrats. The formal functions of the new committee are included in the appendix.

However, the ideas of forward mapping were not totally buried. Although the agencies were to have prime responsibility for information technology, the formal requirements of the committee required that all proposals for the acquisition of equipment had to be forwarded to the committee for approval. It concentrated on strategic planning, attempted to control all IT investments and became preoccupied with controlling systems development in the service by reviewing all plans for such developments.

In order to provide the agencies with advice for improving state service computing and to promote some standardisation across the service, the committee produced guidelines in such areas as the selection and implementation of computer systems, data security and integrity, cost benefit analysis and the security and access of personnel information. Many of these guidelines were expected to be followed by the agencies and control in this way implicitly reflects a forward mapping perspective.

The committee concentrated most of its efforts on IT strategic planning. It attempted to monitor and co-ordinate computing in the state service by insisting that all agencies forward electronic data processing (EDP) plans to the committee and that all submissions for systems development be checked by the committee. As stated previously, formal strategic planning implicitly implies a forward mapping perspective. This and the manner in which the committee attempted to force agencies to plan strategically also reflects a dominant forward mapping perspective.

The departments were required to produce EDP plans regularly, although the definition of "regular" changed often. In 1983 it was decided that these plans would have to be forwarded every five years but in 1986 it was yearly (Hargraves 1986). The committee was concerned that the plans were often only equipment and resources plans and did not especially consider strategic considerations, which had been the whole point of the plans. Hence the committee decided in March 1987 that the EDP plans should only be prepared every 3 years. In October 1987, the members of ICPAC noted the inability of many agencies to provide their first three year EDP strategic plan by the required dates.

In 1981/1982, the CPC reported that the mandatory EDP plans were often not accepted by the departments. While forward mapping could be called the "policy maker's viewpoint", it was obviously not that of the policy implementors. Some agencies found it difficult or useless to develop the plans as it was impossible to predict the changing needs of government. Due to the way government budgets were planned on a year-by-year basis, with only an eight month expenditure/supply cycle, it was difficult for agencies to financially plan for the longer term. The EDP plans were sometimes seen as a waste of time and a proportion of departments would either not complete them or would only provide a token plan.

Concern about the viability of EDP plans in government submissions were also considered by people involved in the committee. M Hargraves, Secretary of CPAC, wrote in 1986:

'Most EDP Strategic Plans merely report successes and failures and comment conservatively on topics required by the Guidelines. Few show any innovation and some Agencies have complained that they don't have the time nor see the need to 'fill out forms' and tell the Computer Policy Advisory Committee what they are doing. The fundamental inability of such managers to see the need from their own Agencies' point-of-view is glaring' (Hargraves, 1986, pp 83-84).

Funding for administrative support was a problem for the committee, given the tasks they undertook. Much of the committee's time was spent in evaluating EDP plans and submissions. In 1986/1987, the committee recognised the need to streamline the approval process to improve efficiency. They did so by delegating authority to approve computer purchases to the heads of agencies, but funding was a perennial issue for the committee.

3.3 Internal and External Environmental Changes and the Decline of the CPC

As well as a general reaction to centralised control by the agencies, during the eighties there were changes within the state government as well as general technological trends which facilitated the re-emergence of backward mapping in IT policy creation and implementation.

In the mid-eighties, the state government started taking a policy making approach consistent with some backward mapping principles. A "Let the managers manage" philosophy and the ideas of participative management, reflected a greater devolution of authority than previously. With these changes, Cabinet promoted greater decentralisation of decision making in many areas as well as information technology. In 1983/84 Cabinet renamed the CPC the Computer Policy Advisory Board (CPAC). Instead of having authority itself, the committee was now only able to make recommendations to the minister responsible and Cabinet. The functions of the committee remained the same, stated one former member of the committee, while its authority was undermined although Hargraves still described CPAC as the

'cornerstone of all investment decisions related to computer purchases and system development in the State Service' in 1986 (p 64).

The 1980s were a time of great change in information technology, and this was also reflected in the state service. Most agencies perceived a need for new or updated computer systems, as is illustrated by the increasing number of submissions forwarded for approval to the committee (Hargraves 1986). Centralised control helped slow this trend because the committee did not have the resources to check each proposal efficiently and adequately.

CPAC's actions still reflected a forward mapping approach and was concerned that it did not have enough resources to adequately control IT developments. The committee put up proposals to Cabinet for more resources several times, but they were rejected. In June 1985 CPAC submitted a report to the Minister of Public Administration setting out the possible future of the committee. The options they forwarded were:

- disband CPAC;
- retain CPAC and reduce its functions
- retain CPAC, rename it the Information Technology Committee and provide at least four full-time staff in the Public Service Board to service it.
- establish a department of Information Technology, to concentrate on Information Technology to take over and expand the role of CPAC (Department of Public Administration 1985) (pp 36-37).

The above recommendations were accepted by Cabinet in November 1985, but after a Cabinet reshuffle in February 1986, no action was taken. While it was suggested at the time that some of the system development failures that occurred were the fault of the committee, others involved in CPAC believed the committee became a 'scapegoat'. One former member stated that decisions concerning information technology projects were made without consulting the committee. In one case, for example, after CPAC had been bypassed, the department involved gained approval for a small add-on and then claimed that they had CPAC approval for the whole system when it failed. Believing they could be forced to accept responsibility for major IT problems, the technical members of CPAC resigned.

This period reflects the height of divergence between the forward mapping philosophies underlying the actions of CPAC's members and the general emphasis of the government on approaches reflecting backward mapping.

On the 30th May 1986 Cabinet decided to re-establish an interim committee while a decision regarding CPAC's long-term future was made. This Interim Computer Policy Advisory Board (ICPAC), had the same functions and structure as CPAC but, without the technical members, was to have a reduced workload and the committee's subcommittees were disbanded.

Due to a lack of resources, ICPAC was forced to act consistently with backward mapping principles. The ICPAC gradually delegated authority for purchasing computer equipment to the agency heads, stating that the committee did not have the resources

to adequately peruse all submissions with the available resources. By 1988, ICPAC believed it had '...abolished most bureaucratic controls and procedures which had been abrogating management responsibility' (Department of Public Administration, 1987/1988, p 1).

In February 1989 CPAC submitted a report to the Minister for Public Administration about the future of ICPAC. The Committee pointed out that there were several reasons for having some centralised control on IT development, such as:

- to ensure that expenditure on IT was justified;
- to ensure co-ordination;
- to ensure a consistent approach when determining the priority of developments;
- to ensure a planned approach when developing systems (Department of Public Administration, 1989, p 8).

The report stated that 'the principle function of ICPAC relates to the first of the above objectives' (Department of Public Administration, 1989, p 8), yet this had not been the intention of the original members of the CPC when the functions had been drawn up in 1981. The emphasis in 1981 was clearly on co-ordination rather than control, but the committee had become committed to the policing of IT expenditure through EDP plans and submission approval. By this time, the principles of backward mapping implied in 1980 were not apparent. The report stated that the committee had not always had the necessary expertise available and, due to the lack of resources, the committee had only been able to give a superficial appraisal of submissions. 'The committee has struggled to demonstrate its effectiveness and maintain its credibility,' the report concluded (Ibid).

The ICPAC members agreed that the committee should be disbanded. The reasons given were:

- a) The terms of reference that the committee had been operating under since 1981 were considered 'outdated and inappropriate'. This was because during the 1980s, the level of computer resources and experience in the agencies had risen due to such factors as:
 - i) rising community expectations;
 - ii) budgetary pressures to gain better productivity;
 - iii) the increased availability and lower cost of software and hardware;
 - iv) the increasing availability of computing specialists;
 - v) better management understanding of information technology.
- b) There had been service-wide reforms to make agency heads more accountable and if outside assistance was needed, consultants could be hired inside or outside the service. Once a new system was developed, agency personnel would gain expertise in the use of that system's hardware and software. The report concluded that it would be a wasteful duplication of effort to also have a central

pool of experts (Department of Public Administration 1989).

In early 1989 ICPAC was abolished.

3.4 Post-ICPAC central controls: Problems with Backward Mapping Recognised

Although the committee believed that it should be disbanded, it also believed that

- a) Departments should still be required to produce EDP plans and that the Heads of Agencies should be forced to undertake post-implementation reviews of all EDP projects. These reviews should be made available to the Audit Department, they believed to ensure the agencies would get all the benefits planned for;
- b) There was a need for expert internal consultants to act as co-ordinators and consultants to:
 - i) give strategic direction to information technology in the state service;
 - ii) give technical consultancy advice where needed;
 - iii) provide independent advice to agencies and government about IT;
 - iv) to provide knowledge in areas such as communications, computer acquisitions and so forth;
 - v) to provide personnel to the Supply and Tender Department to negotiate with suppliers;
 - vi) to ensure that the aggregated purchasing power of the Government agencies is taken advantage of;
 - vii) to advise on disaster planning, security and privacy issues;
 - viii) to aid the development of service-wide systems (Department of Public Administration, 1989, pp 8-10).

The members of ICPAC believed that the committee should be replaced by a unit fulfilling the above functions required by providing 'support to management; leadership to agencies and advice to government' (Ibid, p 11). To work, the unit would have to be client oriented and the agencies would have to be involved voluntarily. This proposal was not followed up.

Since 1989, inter-agency computer policy issues have been determined by the successor to the SCC, the Tasmanian Centre for Information Technology (TASCIT), as the state government's IT body, or by departments themselves. TASCIT officially backed ceased creating policy around 1990 when the role of policy creator conflicted with its role as a commercial body. With the development of a 'Let the managers manage philosophy' and the adoption of participative management principles during the 1980s, agency heads gained more responsibility for IT developments within their department, largely guided by their IT managers. IT managers from some agencies have initiated an IT Managers Forum to consider some service-wide technical issues.

However, in the early nineties there was a growing concern that the full advantages of IT implementation were not being realised in the service. An unstable political environment of this time further exacerbated the difficulties associated with IT systems implementation and promoted the need for service-wide standards.

In late 1992 a task force was established under a management improvement program to investigate the possibility of implementing a unit to oversee computing in the State Service. Following the task force's recommendations, an Information Strategy Unit (ISU) was established to fulfil a perceived need for a centralised body to aid with IT management issues in 1993. The research on which this paper is based was undertaken to ensure that the experiences of the past can be utilised. At this stage it is too early to discuss the role of the ISU.

4 Discussion

From a forward mapping perspective, the committee had problems in fulfilling its policy functions because there were too many functions to fulfil, there was a lack of resources and authority and insufficient support from the agencies. From a backward mapping perspective problems could be attributed to the committee's commitment to centralised control in the face of technological change and an over-concentration on scrutinising EDP plans.

4.1 The Committee and the Reflection of a Forward Mapping Perspective

Throughout most of the lifespan of the CPC/CPAC/ICPAC, a forward mapping perspective was dominant within the committee, consistent with the description of forward mapping as "the perspective of the policy-maker" (p 5) (Younis and Davidson 1990). The main emphasis of the activities of the committee was on the control and guidance of IT policy implementation.

There were, though, some times when the principles of backward mapping were implied but the committee seemed to have trouble coping with this paradigm. When the CPC was overhauled in 1980, centralised control was not emphasised with the acknowledgment that agencies would have prime responsibility for computer installations, for example, yet still the principles of forward mapping were present, producing formal requirements which conflicted with each other.

Elmore criticised the deep distrust of discretion ingrained in conventional theories of administration and government. He states the role of policy should be to direct the attention of individuals at the face of the problem to the problem and provide them with the opportunity to use their skill and judgement. This was the stated purpose of the CPC when it was overhauled in 1980, and the justification for the ISU. However, in the case of the CPC, this role of a consultant mutated into a policing role. The "co-ordinating" role of the CPC was translated to mean "control". Unless the original statements of the CPC in 1980 were considered merely a "sales pitch" to promote the acceptance of a centralised body by the agencies, it seems the intention of the committee was

to allow for the flow of information from the agencies to the CPC as well as the other way.

As the government tacitly adopted a backward mapping perspective during the 1980s the committee had trouble maintaining its credibility as it continued to reflect a forward mapping perspective. It was belatedly forced to adopt a more backward mapping perspective by a lack of resources in the late eighties and was abandoned partially because the interpretation of the committee's formal functions was not consistent with a backward mapping philosophy.

4.2 Problems with Backward Mapping

From a backward mapping perspective, there were advantages to placing prime responsibility with agencies' management and IT personnel. In an area of rapid technological change, combined with changing demands placed on the agencies by new general government policies, they are in a position to respond more rapidly to perceived problems.

Yet the government did not adopt Elmore's alternative, perhaps reflecting shortcomings with the concept of backward mapping. There were problems which were perceived to result from a lack of centralised policy coordination after the demise of the ICPAC, which promoted the creation of the ISU. During this time there were several systems developed which were not considered successful and some duplication of effort in different areas of the state service and service-wide issues, such as communications standards, were not being considered at a broad level.

The alternative to control, when coordination is required, Elmore suggests, to build a coalition of similar interests and problems and give these coalitions the means to solve these problems.

Backward mapping could be criticised for promoting short term solutions or solutions which only meet the needs of the people involved, rather than the whole organisation. It also assumes that those at the "pitface" of the problems faced by the organisation have similar long-term goals as those at the centre of the organisation. Hence, backward mapping is not a perfect solution to the problems of forward mapping.

4.3 Forward and Backward Mapping: Alternative Explanations

The degree of centralisation of the Tasmanian State Service's IT policy creation has been a perennial issue and can be interpreted with the concepts of forward and backward mapping. The fact that both concepts have potential problems helps explain the persistence of the issue.

There are several other ways of considering IT management policy in the Tasmanian State Service, but none of them provide the broad perspective of forward and backward mapping.

4.3.1 Centralisation and Decentralisation of IT Policy Making and Implementation

One alternative viewpoint is to discuss the CPC in relation to the degree of centralisation of policy making, yet these concepts are already included in the concepts of forward and backward mapping. It was a general belief that the policies CPAC had followed belong to an era characterised by the strong

centralist policies initiated by Cabinet. The Computer Policy (Advisory) Board (CPC/CPAC) was closely tied to an era when Treasury had a strong policing role. As agencies became more independent of the central agencies, CPAC was bypassed and it lost some authority as a global budget strategy was adopted.

As a policy of "let the manager manage" philosophy developed, and managers in the separate agencies were given more responsibility for decision making, CPAC became undermined. One former member of the committee stated that, because CPC/CPAC had to put an emphasis on centralisation while the agencies wanted to decentralise, the CPC/CPAC's role was bound to be difficult.

This viewpoint, however, does not take into consideration the development of the ISU when a "let the managers manage" and participative management philosophies were still used. The concepts of forward and backward mapping include the issues of centralisation and decentralisation and more adequately describe the conflict between the two paradigms as the CPC attempted to control IT management policy while managers in the agencies pushed for more devolution of authority by covering such aspects as control and autonomy and the creation and implementation of policy.

4.3.2 Top-Down / Bottom-Up Policy Implementation

The concepts of top-down and bottom-up policy making are closely related to forward and backward mapping and some, such as Ham and Hill (1984) use them interchangeably. However, there is some confusion as to whether the concepts refer to the top and bottom of the organisation or of the policy making process itself. Elmore refers to the top and bottom of the policy-making process, but others do not imply this notion of time, referring only to the organisational hierarchy (Noble 1991). Hence, although the terms are more commonly used, they are not utilised here.

4.3.3 Technological Determinism and Structural Change

The moves from centralised to decentralised IT management policy making, or the forward/backward mapping dichotomy, could also be discussed in terms of technological determinism (Scott 1990). In the late seventies, the CPC was clearly committed to mainframe computing, a stance which helped lead to its overhaul. In 1986, Hargraves concluded that the increasing number of personal computers would force a technologically-induced trend towards more agency distribution yet, again, this does not explain the recent introduction of the ISU.

A view of technology as a deterministic force has been criticised. For example, Stewart and Garson (1983) after a review of the literature in this area, concluded that although there were studies suggesting that technology did help to determine the structure of an organisation, this impact did not justify a technological deterministic view. Scott (1990) stated the link between technology is considered "reasonably consistent but not particularly strong" (p 121). Hence, a viewpoint that takes technology as a deterministic influence on

organisational structure is inadequate for describing the committee's changing role.

4.3.4 Changes in Organisational Structure and Levels of Organisational Maturity

The implementation of IT management policy is also described in terms of the level of maturity an organisation exhibits in relation to IT management. The best known of these models is Nolan's (1979) stages of growth. However, in addition to the criticisms concerning its validity as descriptive models (for example refer to King and Kraemer 1984 and Benbasat et al 1984 in (Friedman and Cornford 1989) ch 2), the emphasis of the model on appropriate levels of control, places this model firmly within the forward mapping paradigm. Most of the stages in his model, contagion, control, integration and data administration refer to the level of control appropriate at the time. Although he recognises that at times more discretion is appropriate for those outside the centre of the organisation, Nolan's stages of growth model does not give as broad a view as the concepts of forward and backward mapping when discussing the roles of a centralised body.

Ward et al's (1990) three stage model discussed earlier can be criticised in the same manner. The model's strong emphasis on management actions and control makes this very much a "policy maker's perspective" and makes it also part of the forward mapping paradigm. This model could also be criticised for being technologically deterministic as it assumes that technology must be centrally planned so that appropriate organisational change can be achieved through technological developments. Such evolutionary models of organisational change tend to take a short-sighted view of developments. The concepts of forward and backward mapping, on the other hand, can be used to explain many situations where the implementation of policy is an issue.

5 Conclusions

The degree of centralisation and the role of a centralised body for IT management policy creation and implementation has been a perennial issue in the Tasmanian State Service. The persistence of the debate surrounding the issues reflects the dichotomy between forward and backward mapping. The concepts help explain the ongoing nature of the debate and the difficulty of resolving the issue of an appropriate degree of centralisation in a large organisation. While the problems the CPC encountered illustrated the difficulties of forward mapping as Elmore described them, the lack of policy creation regarding service-wide issues in the vacuum left by its demise and the creation of the ISU point to difficulties with backward mapping. The changing roles of these centralised policy making bodies strongly reflects changes in their external political environment.

The problems with both forward and backward mapping reflect the complexity of implementing policy. These concepts are great simplifications of the process in reality, as the above case study illustrates. However, as a tool of analysis, they are more appropriate than the concepts of top-down and bottom-up policy implementation as they are used in the information systems literature and are at an

appropriate level of complexity for practitioners in this area. An understanding of the concepts of forward and backward mapping could aid policy makers and implementors in situations similar to those described by the case study by focusing on the relationship between the creation and implementation of policies.

Appendix: Formal Functions of the CPC/CPAC/ICPAC

The functions of the CPC, CPAC and ICPAC were defined as:

1. To coordinate and maintain a general oversight of the use of computing and associated automatic data processing facilities throughout the Tasmanian Government Service, including Departments, instrumentalities, authorities and Agencies of the Crown;
2. To co-ordinate the operations and policies of any State-owned computer facilities;
3. To investigate proposals for the acquisition of computers, ancillary devices, computer systems, word processors, software and support systems including the use of non-government computer bureau services, and to determine, subject only to Cabinet directive, availability of finance, and any restriction which may exist under legislative and regulatory provisions whether or not such proposals should be proceeded with either in whole or in part;
4. To co-opt the services of specialists and to establish such Sub-committees and Working Parties as it considers necessary to enable it to fulfil its functions;
5. To ensure provision is made for safeguarding the privacy of personal information held within computer files;
6. Generally to advise Cabinet on the financial implications of any proposal falling within the scope of its responsibilities and upon any matters associated with computer services policy and administration which it considers could have a bearing on the Government's policies including:
 - The impact of technological development upon employment and education;
 - Security Standards;
 - Development Priorities;
 - Recruitment and Training; and
 - Retraining and redeployment.
7. Of its own motion, to recognise as Facilities Centres such data processing facilities operating within Agencies as, in the opinion of the Committee, is deemed appropriate for the proper coordination and administration of the State's computer services;
8. To issue, from time to time, detailed guidelines relating to the acquisition, management, administration and security of computer equipment and to promulgate such guidelines throughout the government service;
9. To make an annual report to Cabinet (Public Service Board, 1985, pp 31-2).

REFERENCES

Auditor General's Department. *Annual Report of the Auditor General*. Tasmanian State Service, 1980/1981.

Brussard, B.K. "Information Resource Management in the Public Sector." *Information and Management* 15 (1988): 85-92.

Department of Public Administration. *Report of the Secretary for the Year ended 30 June 1985*. Tasmanian State Service, 1985.

Department of Public Administration. *Report of the Secretary for the Year Ended 30 June 1987*. Tasmanian State Service, 1987/1988.

Department of Public Administration. *Report to the Minister of Public Administration on the Interim Computer Policy Advisory Committee and Longer Term Arrangements*. Tasmanian State Service, 1989.

Elmore, Richard F. "Backward Mapping: Implementation Research and Policy Decisions." *Political Science Quarterly* 94 (1979): 601-616.

Friedman, Andrew L. and Dominic S. Cornford. *Computer Systems Development: History, Organisation and Implementation*. Wiley Series in Information Systems, eds. Rudy Hirschhiem and Richard Boland. NY: John Wiley and Sons, 1989.

Hargraves, Marita. "Computing in the State Public Service." Masters thesis, University of Tasmania, 1986.

Hogwood, Brian W. and Lewis A. Gunn. *Policy Analysis for the Real World*. New York: Oxford University Press, 1984.

Lorsch, J.W. "Managing Culture: The Invisible Barrier to Strategic Change." *California Management Review* XXVIII (2 1986): 95-105.

Public Service Board. *Computer Policy Committee: Annual Report*. Tasmanian State Service, 1981-1982.

Public Service Board. *Annual Report*. Tasmanian State Service, 1985.

Scott, W Richard. "Technology and Structure: an organisational level perspective." In *Technology and Organisations*, eds. Goodman et al. San Francisco: Jossey Bass, 1990.

Stewart, Debra W and G. David Garson. *Organisational Behaviour and Public Management*. NY: Marcel Dekker Inc, 1983.

Younis, Talib and Ian Davidson. "The Study of Implementation." In *Implementation in Public Policy*, ed. Talib Younis. 3-14. Aldershot USA: Dartmouth, 1990.

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